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for Workgroups

**SERVICE &
RELIABILITY:**
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**NETWORK
EDITION
MAGAZINE**

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What You Need
To Know About
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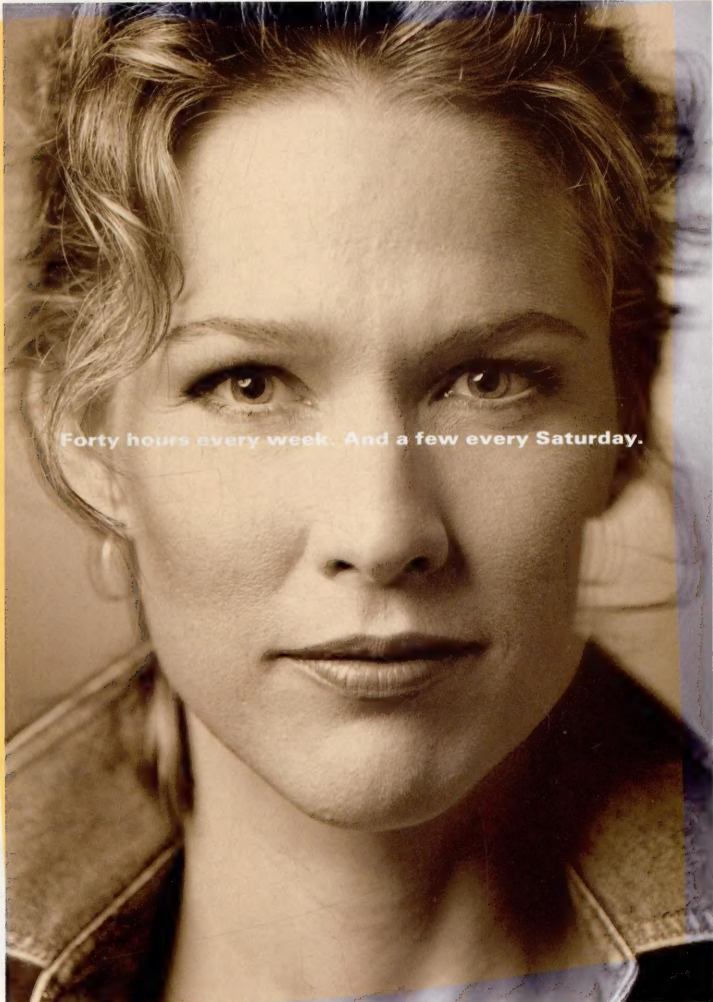
THE BEST PRODUCTS OF 1993

Our Editors Pick Their 43 Favorites

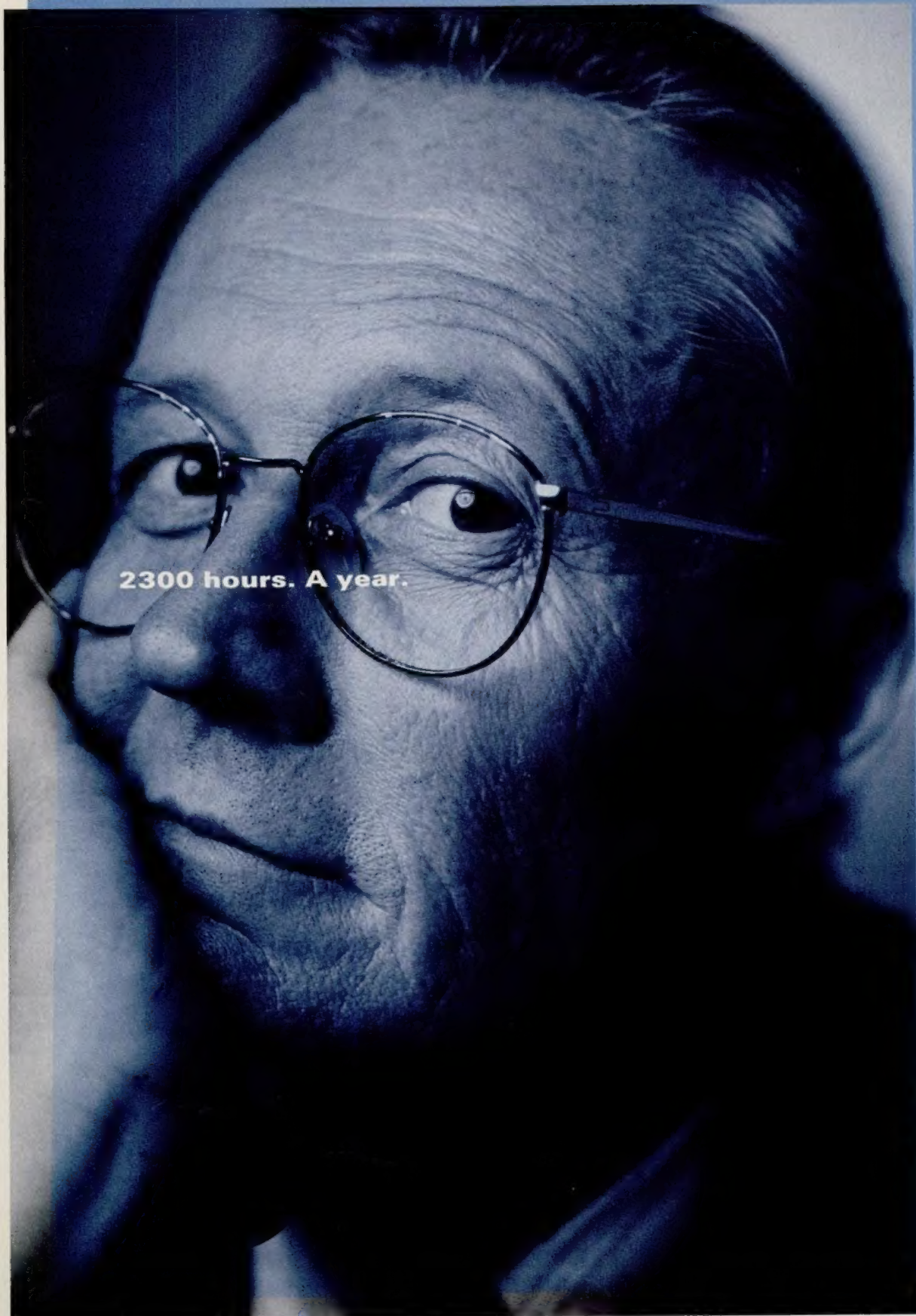
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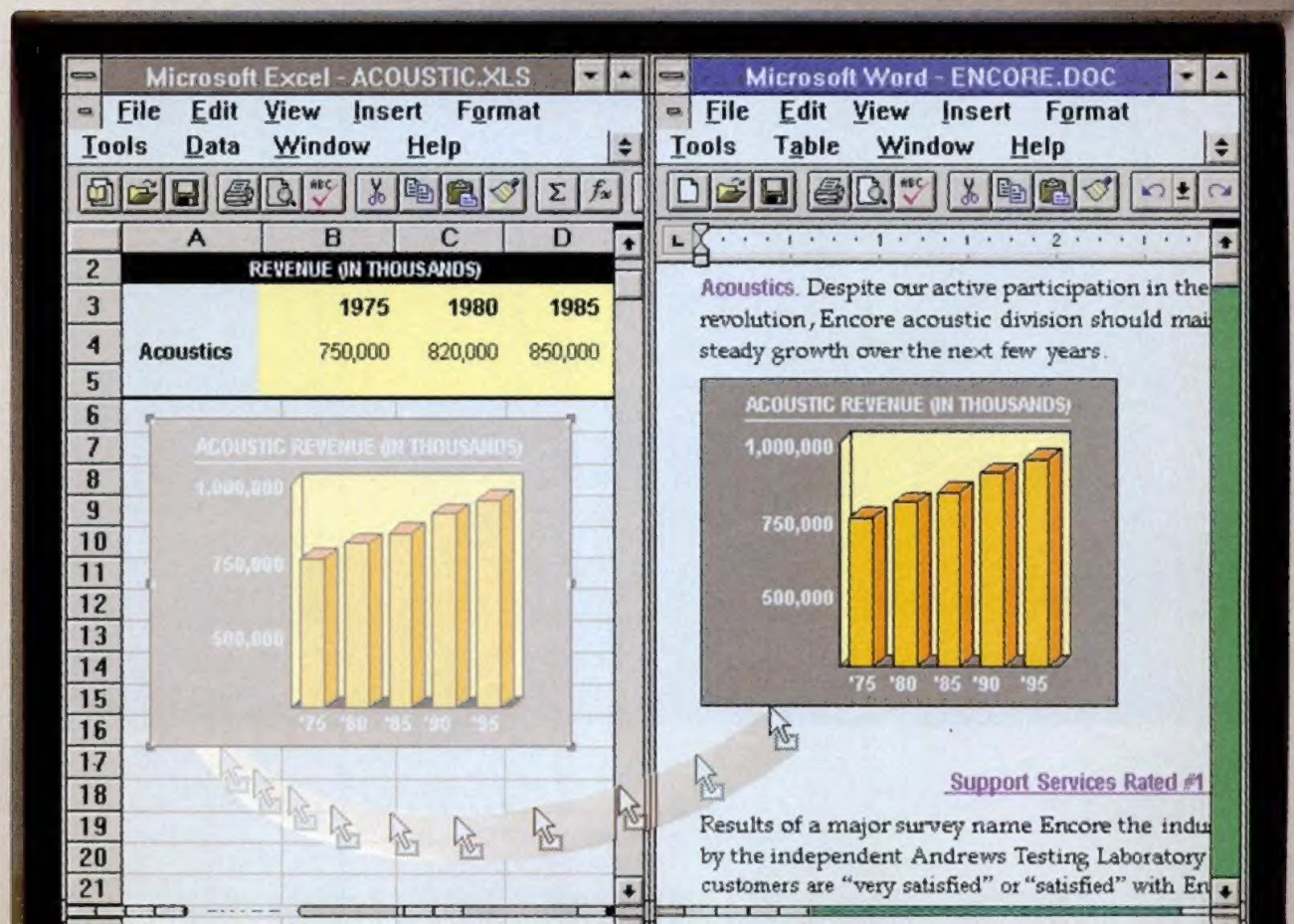


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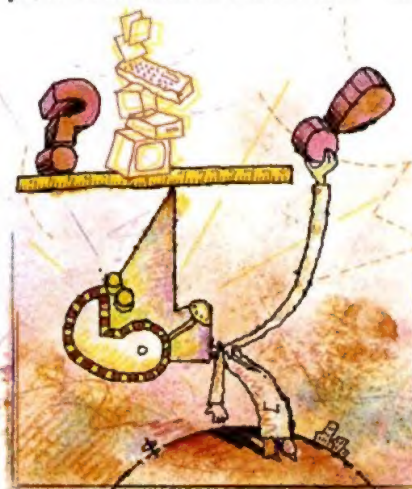
What makes a "best" product? In this issue, we offer two answers. The first is our traditional listing of the products our editors consider the most exciting of the previous year (see "The Best of 1993"). Admittedly, the products we chose are

our editors' personal favorites, products that we turn to when there is real work to do or that we'd recommend to friends and family. Our choices are more subjective here than in our Awards

scribers whom we ask to report to us on the quality and performance of vendors whose products they buy and use.

We don't just settle for information on how the company's product did initially. We want to know about your experience when something goes wrong. We ask about your perceptions of technical support and repair services. To ensure that we get a representative sample, we send out as many as 17,000 questionnaires for our PC surveys and 7,500 for the other surveys, the largest sample we know of for any computer industry survey.

In this issue, we've combined four hardware product surveys into a single story ("Keeping the Customer Satisfied"). The article covers PCs, laptops, monitors, and printers. The results are our subscribers' judgments on whose products work best and what vendors provide the best technical support and repair services. You can argue with our decisions in "The Best of 1993" story—and we'd be happy to hear from you on this topic. In the case of the Service and Reliability surveys, we're simply the bearers of good (and bad) tidings.—Joel Dreyfuss



for Technical Excellence, which appeared in the previous issue of *PC Magazine*, but they are still—we think—fairly well informed. After all, we see so many products in any year that we set fairly high standards.

Another way of picking the best products is to let *you* do it. For several years now, we've published our Service and Reliability surveys on hardware vendors and Service and Support surveys on software companies. These mail ballots go to a random sample of *PC Magazine* sub-

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COVER STORY

Cover Story

The Best of
1993

BY JOEL DREYFUSS

Of all the new products launched in 1993, which are the ones that really make a difference? Our editors offer an honor roll of their personal favorites: products that made computing better, safer, more powerful, and more fun. These are the products our editors and contributors would use themselves or recommend to Mom.....109



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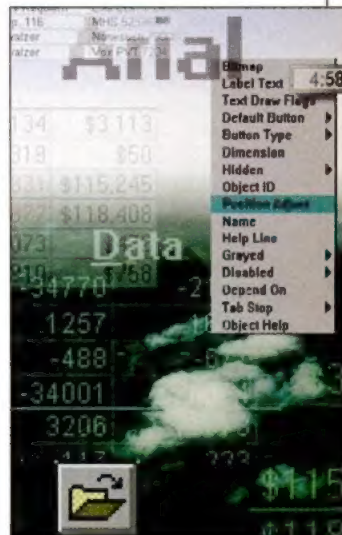
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BY CRAIG STINSON

In this roundup, *PC Magazine* reviews a record low of five new spreadsheet products from two vendors. Despite the meager numbers, the power and richness of the Windows contenders from Borland and Lotus carry the spreadsheet category to new heights. And there's now a real OS/2 player as well.189

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BY JAMES KARNEY

The popularity of mice has skyrocketed as Windows has taken over the desktop and even most laptops. Today's mice feature ergonomic designs to prevent repetitive-stress injuries, along with improved drivers that you can customize to your work habits. We assembled a test team of left-, right-, big-, medium-, and small-handed men, women, and children to find out whether there is a perfect mouse.....245

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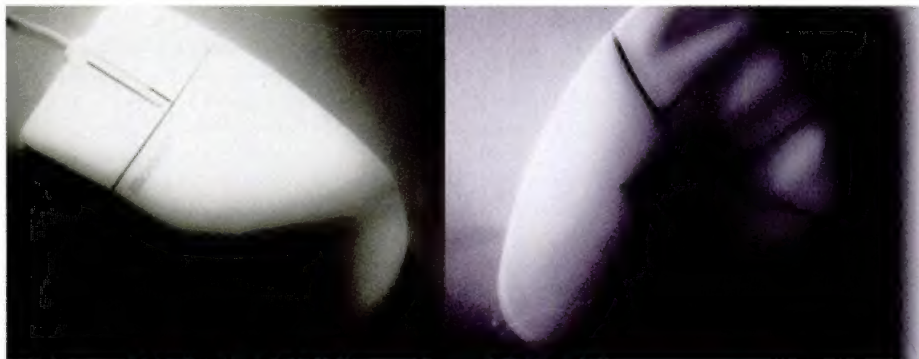
The Whole Picture

BY JOEL DREYFUSS

With competition heating up in all areas of the computer industry, many vendors are striving to differentiate themselves from an ever-increasing, ever-similar pack with their warranties and their service and support offerings. In our most recent Service & Reliability survey, we asked *PC Magazine* subscribers to tell us what they think of the vendors who sell and service their desktop and notebook PCs, monitors, and printers161

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Say goodbye to those tame old mice. The Microsoft Mouse, Version 2.0 (left), has a new, contoured shape that supports the palm better; Logitech's MouseMan Cordless (right) uses a radio transmitter to eliminate tangle-prone cables (page 245).

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PC Magazine Reviews

Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25e's.

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"A butt-kicking program! About time! Amen!"
Robert D. Pinson, TV Production

Cynthia Krol
Westlake Village, CA

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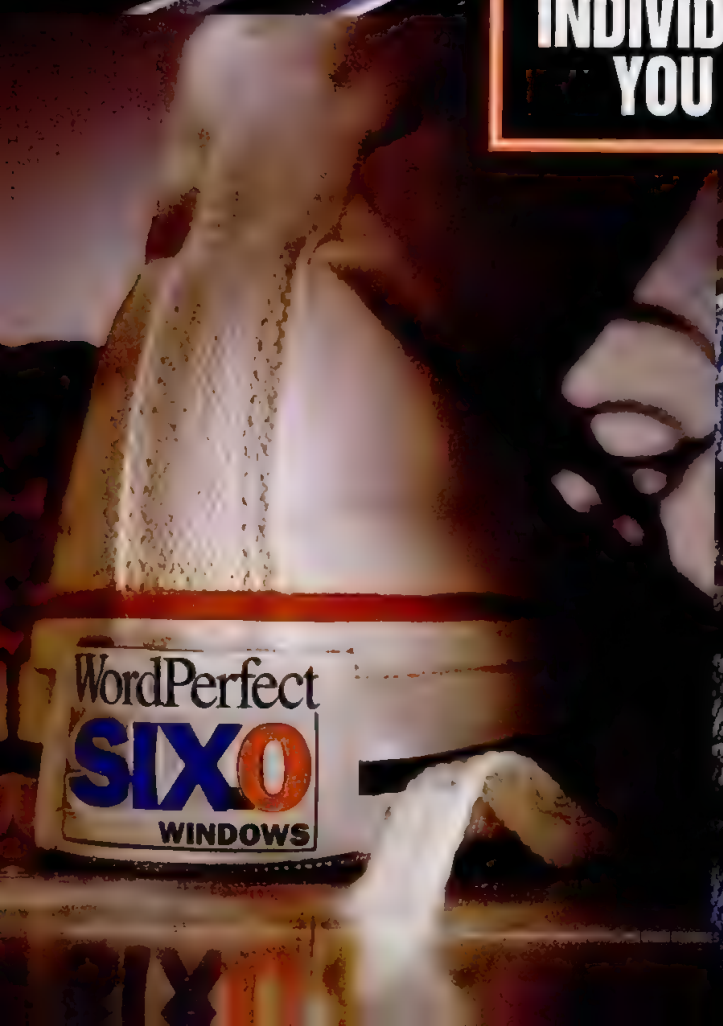
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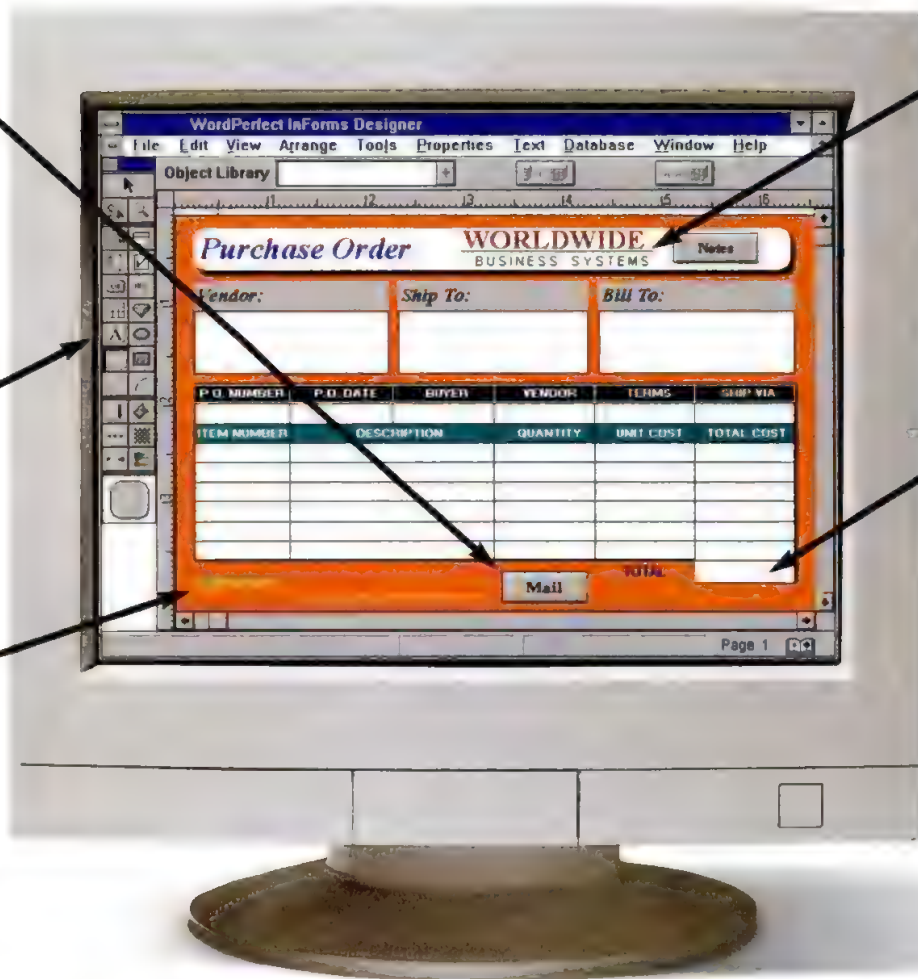
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Letters

SUPPORTING SOFTWARE

It was with some interest that I read Michael J. Miller's column ("Software Ain't Heavy, It's the Support") in the November 9, 1993, issue. As you are probably well aware, few vendors release products that lack bugs. I don't like the prospect of paying the manufacturer for participating in their quality control shakedown just because I found a bug on day 91 after I purchased software. What I expect from vendors is some consideration for the veteran user who finds a bug, goes to some difficulty to find its limits and parameters, and then engages the vendor's technical support department in a dialog that can only serve to improve the product.

*Douglas Campbell
Culver City, California*

Not mentioned in Miller's column and overlooked in most discussions of paying for support is the issue of bugs. Should we have to pay the \$25 or \$150 for a support call if the problem is caused by a bug in the software or by incorrect information in the manuals? This scenario is never mentioned in the vendors' descriptions of their support policies.

*Robert J. Sandler
New Milford, New Jersey*

I tend to side with software manufacturers' position that technical support should carry a price, provided that the users' questions are not related to inherent software glitches. Most people who buy "higher-end" software packages don't bother reading the accompanying phone book-sized manuals before plunging head-first into the program; ultimately, they end up calling technical support to teach them the software.

*Phillip Grohs
Rural Hall, North Carolina*

DEBUNKING THE SUPERSTORE MYTH

John C. Dvorak's October 26, 1993, column, "Superstores are Not Super," really hit the nail on the head. Sure, you can usually find the superstores stocked with big-name monitors, printers, and software packages, but beyond that the pickings



*Should we have to
pay for support related to
software bugs?*

are slim. And despite their pronouncements to the contrary, superstores rarely have the lowest prices.

Everything has to be retail-packaged and self-explanatory; the sales people know about only a few of the big-ticket items. This kind of short-sighted approach is, as Dvorak pointed out, costing superstores sales while keeping smaller stores and mail-order companies in business.

*Kent M. Dolan
Norcross, Georgia*

OS/2 APPS AT LAST

Thank you for reviewing two OS/2-specific word processors in your November 9, 1993, word processing review, "Documents Take the Center Stage." I look forward to seeing more reviews of OS/2-specific software in future issues of *PC Magazine*.

*David D. Nelson
Battle Ground, Washington*

PLACE YOUR BETS

I really enjoyed your informative article "Networking Operating Systems: Playing the Odds" (October 26, 1993). As a network consultant, I feel that one network is not necessarily the right answer for all situations, and your article ex-

plained some of the differences amongst the various options.

*James R. Daneke
Las Vegas, Nevada*

SEQUEL TO SQL

Your October 12, 1993, in-depth review of PC Client/Server Databases ("PC-Based SQL: Time to Commit?") included extensive benchmark and performance monitoring. The testing, however, was performed on a single-processor 50-MHz 486 PC. I have to wonder if anyone really cares which product is best tuned to run on a PC with this configuration. These tests should have been conducted on a multiprocessor database server, or at the very least a Pentium-based PC. This was like testing a new, high-octane gasoline on an old Ford Pinto. The results of the tests may be statistically valid, but who cares?

*Terry Carr
Cincinnati, Ohio*

I found the conclusions in "PC-Based SQL: Time to Commit?" to be highly suspect, as there was no consideration of any database running on an SCO Unix platform. In at least two instances, a reviewed product was described as either lagging its Unix version in features, or having only recently caught up to its Unix version, but there was no mention of performance levels on the SCO Unix platform.

Despite IBM's massive hype, OS/2 has yet to catch SCO Unix in sales for PC-based SQL servers. And neither OS/2 nor NT will be in the same league of stability as SCO Unix for some time to come.

*Leonard E. Jarvis
Richmond, B.C., Canada*

•We did not exclude SCO Unix—we simply asked each vendor for a 32-bit SQL database engine to run on an Intel platform in a NetWare environment. None offered SCO, apparently feeling that their NLM and OS/2 products would perform better. Also, while multiprocessor testing was not possible for most of the reviewed SQL servers due to operating system limitations, *PC Magazine* has SMP server tests slated for the near future. But even

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LETTERS

with a 50-MHz 486, no SQL product showed 100 percent CPU use.—Ed.

ACCOUNTING FOR ALL ACCOUNTS

After reading the reviews of LAN-based accounting software ("The Price Waterhouse Report: LAN-Based Accounting at the Crossroads," October 26, 1993), I was disappointed to note that there was no reference to the cost accounting modules or capabilities of any of the systems.

Even in today's service- and distribution-oriented economy, cost accounting is still an important management tool and should not be ignored by the developers of software packages.

Kurt Fraenkel
Lafayette, California

EDUCATIONAL GRAMMAR

I have to disagree with the indictments made against grammar checkers by John C. Dvorak in his October 26, 1993, Inside Track. If the assumption is that grammar checkers are intended to teach grammar rather than reinforce previously discussed concepts, I would agree with the condemnation. Grammar instruction left solely to a grammar checker would be deficient at best.

We at Lewis-Palmer High School use WordMap in the proofreading and editing steps of the writing process and, let me assure you, there is a marked difference in our students' practical usage of grammar since we started using the program.

Gary D. Brown
Monument, Colorado

PIZZA AND PROGRAMMING

As a dosa-eating, coffee-drinking Indian software professional, I disagree with John C. Dvorak's blanket statement that "the best code is still done by small teams of young American coders eating pizza and drinking Coca-Cola," and I also disagree with what Dvorak has to say about developing software in India (Inside Track, October 12, 1993). While it is true that many Indian programmers lack exposure to some of the latest methodologies and tools compared with their American counterparts, I don't think Indian

programmers are in any way inferior in terms of their ability to accurately code a given specification. I have seen some "professional" C code generated outside of India that was shocking.

As for drinking cola and eating pizza, we already have Pepsi here and both Coca-Cola and McDonald's are on the way.

Venkat Krishnan
Shimpoli Village, Bombay, India

I am a computer scientist living in Costa Rica. As in India and many other countries, we don't have enough economic resources to compete against the U.S. in software production. But let me assure you, Mr. Dvorak, that in all these countries, those people that you call "cheap foreign coders" are as good as American coders. If you have yet to see any decent

*In many countries, the ability
to produce programming
code is constrained by
the lack of economic resources
necessary to compete
with the U.S.*

code originating from a country other than the United States, maybe you should look again.

And by the way, we eat pizza and drink Coca-Cola here, too....

Francisco Alba
San Jose, Costa Rica

DEBUGGING THE BUGS

Though I always enjoy reading Jeff Prossie's Tutor column, I especially appreciated the miniseries (from September 28 through November 9, 1993) which discussed writing DOS utilities using the DEBUG assembly language utility.

J. W. Bruce
Omaha, Nebraska

After applying some tips from the helpful DEBUG articles, I was delighted to learn that I am the proud owner of DOS Version 8. This startling upgrade to my sys-

tem was achieved by using DEBUG and following the advice to multiply my major version number by 10h rather than Ah.

George G. Martin
Milford, Michigan

THE SCENT OF A PC

I am normally quite resigned to the fact that the hardware on my desk will never approach that at *PC Magazine*, yet I could not help feeling a bit envious when I read "The Desktop Athlete: Five Sports Simulation Programs Challenge Computer Jocks" (After Hours, September 28, 1993). We are told that "...the roar of the crowd, the swish of the net, the crack of the bat, and the smell of burning rubber are as near as your PC."

As for my PC, a Sound Blaster it does have; a Smell Blaster it does not.

James A. Marken
Hamamatsu-shi, Japan

CORRECTIONS AND AMPLIFICATIONS

Though at the time of our First Look evaluation of Microsoft Visual C++ 32-Bit Edition (November 9, 1993) there was no DEC Alpha support for the Microsoft Foundation Class Library, that support is now available.

In *PC Magazine's* First Look review of Avery's LabelPro for Windows (November 9, 1993), the review erroneously states that LabelPro for Windows does not allow you to specify the number of labels to print at a given time. In fact, a check box in the "Print" dialog box lets you specify either the number of labels or pages you want to print and, when printing from a merged list, the function allows you to specify the number of sets (copies) you need printed.

HOW TO WRITE TO PC MAGAZINE

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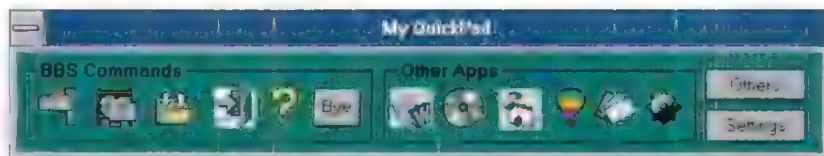
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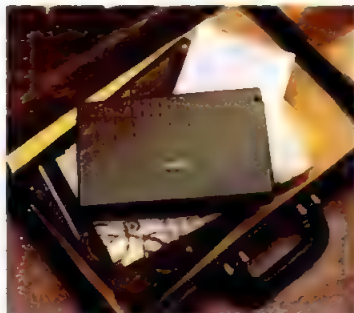
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Xircom Ethernet adapter (10BT or Coax).....	\$349

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Extra battery	\$99
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- Fully-featured power management.
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PACKAGE 1

386SL Contenda: \$995

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486SL Contenda: \$1495

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- 2MB RAM (386SL); 4MB RAM (486SL)
- 80MB IDE hard drive

PACKAGE 2

386SL Contenda: \$1295

Lease \$55/month

486SL Contenda: \$1795

Lease \$65/month

- 4MB RAM
- 80MB IDE hard drive
- External 3.5" floppy disk drive
- Microsoft DOS 6.2 and Windows for Workgroups 3.11. Plus Lotus Organizer.

PACKAGE 3

386SL Contenda: \$1595

Lease \$67/month

486SL Contenda: \$2195

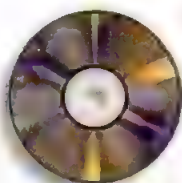
Lease \$79/month

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- External 3.5" floppy disk drive
- Custom leather carrying case
- Extra battery
- Choice of internal fax modem
- Microsoft DOS 6.2 and Windows for Workgroups 3.11. Plus Lotus Organizer.

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Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

Chips in Space

Exploring new chip materials.

When the next mission of the space shuttle Discovery takes flight in January, there will be an experimental payload on board that could reshape the PC industry in dramatic ways. The experiment calls for growing wafers of a semiconducting material, called

gallium arsenide, that's eight times as fast as silicon and consumes one-tenth the power.

Silicon is not the only semiconducting material found on earth, it's just the most plentiful and the cheapest. In fact, it's not even the best material for integrated circuits because speed increases can be achieved only through the integration of chip design. The point at which the electronic elements approach the same scale as the atoms of the semiconductor material (when chips cannot get any smaller) is called the *atomic or quantum limit*. So researchers are investigating alternative materials.

Gallium arsenide, a compound of gallium and arsenic with powerful electrical properties, is already used in supercomputers and military hardware. But today it can't be mass-produced like silicon can because of a delicate, expensive manufacturing process that requires an environment free of impurities that can impede signal flow. "Anyone and their uncle can grow a silicon wafer that's not defective, but with all other semiconductors, there are impurities. Especially with compound semiconductors. Their performance doesn't reach anywhere near theoretical performance," says Dr. Alex Ignat



tie, director of the Space Vacuum Epitaxy Center at the University of Houston.

The challenge facing Ignatiev is to reduce defects in semiconductor materials. A \$13 million project funded by NASA, academia, and an industry partnership, including Space Industries of League City, Texas, may solve the problem. Ignatiev and his team are sending gallium arsenide into space on board the Wake Shield Facility. There, suspended 190 miles above the earth in the Wake Shield Facility, seven 3-inch wafers of gallium arsenide will grow. The free-flying platform creates a unique ultra-vacuum in space (it's 10,000 times as pure as the cleanest of terrestrial clean rooms). 20,000 atomic layers (one atom thick) of fresh material will grow one layer at a time in a process called epitaxy, where an electric field is used to orient the atoms into a crystal lattice. Full growth is expected to take about 40 hours. The space shuttle will then retrieve the chip factory and continue on its six-day mission.

When will you be able to pop out your 50-MHz silicon chip and pop in a 400-MHz gallium arsenide chip? Not for some time, since billions of dollars have been invested in silicon production and gallium arsenide

chips require different circuitry and processing than silicon. The long-term goal of the project is to make the material in commercial quantities in space for use in computer chips, high-frequency transistors in cellular phones, and high-definition television. By the fourth mission, scheduled for the summer of 1997, Ignatiev hopes to grow 300 wafers in space.—Carol Levin

Pentium Killers

IN NO RUSH TO PAY PREMIUM price for a Pentium PC? If you can wait a year, chances are you'll be able to get a Pentium-compatible system powered by a Pentium-class processor from AMD, Cyrix, or even Texas Instruments—and pay far less than you can imagine. By the end of 1994, there will be more versions of Pentium chips from Intel, which should also help drive down the cost.

AMD's Pentium killer is code-named K5. Due by the end of 1994, it will have all the latest technical features. Like the Pentium, it will be superscalar, which means it will execute more than one instruction per clock cycle. (A 386 takes about two clock cycles to execute an instruction, and a 486 takes one.) AMD says the K5 will operate at 3.3 volts and be manufactured in the 0.6-micron process that runs at 100-MHz without much heat. Of course, it will use AMD-scripted microcode, and it won't be pin-compatible with Intel's Pentium chips.

Cyrix is working on an innovative chip architecture code-named M1, which will be used in its Pentium-class chips by the end of 1994. The Cyrix chip will use a superscalar design that will speed most applications beyond today's Pentium performance. The M1 will use super pipelining, which the Pentium doesn't, to remove data dependencies without recompiling. Cyrix expects the chips to operate at over 100 MHz.

While everyone is gunning for the Pentium, don't count Intel out of the fight. The Pentium is its franchise, and sources say the forthcoming 3.3-volt, 0.6-micron P54C will operate somewhere between 80 and 100 MHz.—Christopher Barr

Pipeline *By Robin Raskin* Cocooning Software

More than a decade ago, professional trend-sayer Faith Popcorn predicted we would become a nation of cocooners, finding it preferable to stay at home and nest rather than venture out into the harsh realities of dinner reservations, theater prices, and crowds. Digital cocooning is certainly on the upswing. On-line services, CD-ROM reference software, and compelling multimedia titles are quickly taking the place of a visit into town. The latest manifestation of digital cocooning is "cocoon beautification" software—software designed to help you improve your abode.

Second only to screen savers, software products that help you beautify your home are flocking into the office at a healthy clip.



Tops on my list of favorites include Home Survival Toolkit (\$39.95; Books That Work, 415-326-4280). Brought to us by the same clever folks who published Build Your Own Deck, this floppy disk-based guide for fixer-uppers offers animated tutorials—from basements to roofs, gutters to garbage disposals. Animations, sound, and a carefully scripted drill-down

approach to information make this a truly useful disk. Interactive worksheets such as a stain removal guide and a paint estimator help personalize the experience.

Two other packages, 3D Home Architect (\$59.95; Broder-

bund, 800-423-9999) and Home Design for Windows (\$14.95, Expert Software, 800-759-2562) are nothing less than extremely focused CAD packages optimized for home building, renovations, and interior design. Both supply you with building plans you can modify easily, libraries full of relevant "objects" to help you build quickly, and helpful job-costing worksheets. Home Design even includes reference materials, such as standard sizes of bathroom fixtures. Visio Home (\$99; Shapeware, 800-446-3335) is a targeted version of Visio, the company's top-notch diagramming package. The same "smart shapes" that you find in the full-fledged package resurface here as objects for home, landscape, kitchen, and bath. Visio's "smart shapes" know something about what they're being connected to and how—so, for example, a door will snap to the wall. Even the kids can cocoon. Let them try Davidson's Kid CAD (\$49.95; 800-545-7677), a mini-CAD package that lets kids design Lego-like buildings and then populate them with furniture and folks.

And for those who find the prospect of home improvement too daunting, consider jumping ahead to the ultimate cocooning experience: virtual cocooning. Virtus VR (Virtus Corp., 800-847-8871) is a \$99 virtual reality product that lets you explore and alter 3-D interiors. Samples include the White House and a futuristic apartment. Or go for broke and call VREAM (312-477-0425). With VREAM's \$795 Virtual Reality Development System, you can create just about any world that you want.

Best wishes for the new year, and don't forget to leave the cocoon every once in a while.

Robin Raskin is an executive editor of PC Magazine.

The Kitchen Sink Operating System

DOLLAR FOR DOLLAR, YOU'RE GETTING more operating system today than ever before. What began in the DOS wars—vendors throwing in extra utilities for the price of DOS—will pick up steam in future versions of Windows: Chicago, Cairo, and even the Windows-at-Work variant called WinPad.

In 1991, DR DOS, now owned by Novell, pioneered value-added DOS by tossing in memory management, the PC-Kwik disk cache, and SuperStor disk compression. Novell continues the tradition with its DOS 7, which includes 386 multitasking, security, and networking software. Microsoft considered putting networking in DOS 6, but chose to sell the Workgroup Connection separately. Our guess is that MS-DOS 7 will include networking and 386 multitasking.

Microsoft won't be a follower when it comes to Windows. It

plans to incorporate more features, utilities, and apps into all flavors of Windows. Cairo, the code name for the follow-up to NT, is an object-oriented OS that shares a new interface with Chicago, the code name for the next release of Windows. Chicago will ship in the second half of 1994; Cairo in 1995.

Chicago will be far more integrated than Windows 3.1, and, like OS/2, will run DOS apps without requiring DOS. Chicago will

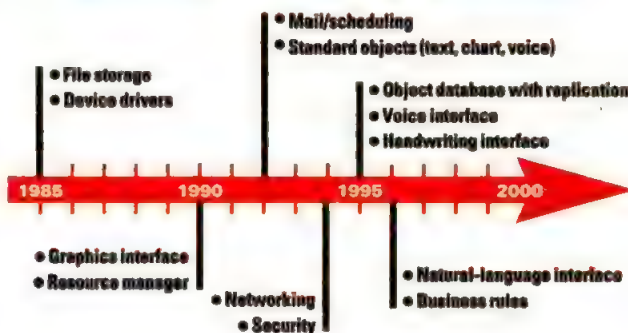
include the networking features of Windows for Workgroups, the runtime version of Video for Windows, and a new device driver model called the Plug and Play architecture, which automatically detects and configures network, SCSI, PCI, and PCMCIA cards. WinPad, which Microsoft is developing for PDAs, will offer applets for wirelessly networking synchronizing files.

As Microsoft's operating systems evolve to an object model, apps will become components of the OS, much the way Word for Windows offers drawing, graphing, and mathematics equation modules. The company plans to augment future versions of Windows with an object database complete with replication, voice and handwriting interfaces.

IBM and Novell are beefing up their operating systems and plan to release symmetric multiprocessor versions of OS/2 and UnixWare in 1994. And don't forget Apple, IBM, and Taligent's joint effort to develop an object-oriented system to run on the PowerPC chip. Taligent is expected in 1995.

—Christopher Barr

Microsoft's Theory of Evolution



As Microsoft's operating systems evolve to an object model, applications will become system components. Chicago, the follow-up to Windows 3.1, is expected this year; Cairo, the follow-up to Windows NT, in 1995.

Source: Microsoft Corp.

Flashy Future

TECHNOLOGY OFTEN MOVES FAR too slowly for the technologists. Case in point: Last year it was predicted that flash memory chips would proliferate and replace magnetic hard disks in notebooks. (Unlike DRAM, flash memory chips retain their contents in silicon even with no power.) It never happened for a number of reasons, mainly because of the steep price. Today, a flash memory drive still costs about ten times as much as a conventional hard disk.

That may change now that the technology is catching up to expectations. Both Intel and AMD, the world's two largest flash memory suppliers, are ramping up production on low-powered, high-capacity chips, and Intel recently introduced flash chips in 16- and 32-megabit densities. In the chip business, higher densities equal higher performance.

Intel chairman Gordon Moore, who, 20 years ago, predicted the growth of chip densities in what's known as Moore's Law, says that very soon flash memory will replace DRAM in many applications. At 256 megabits, DRAM is reaching its physical limit. "Flash memory will be a bigger business than DRAM, over time. DRAM growth will flatten due to its cell size. DRAM

requires a large capacitor; make it too small and you could wipe out the bits," says Moore.

Flash memory has a different architecture and a brighter future. "Flash memory can be scaled to any size as long as we keep within the atomic size," explains Moore. "It may be scaled as small as 0.25 micron or even 0.1 micron, although it will probably take 20 years to get there. The manufacturing costs of making the chips so small will slow that progress down long before it reaches its physical limits."

Although DRAM will never be replaced completely because its write speeds are far faster than those of flash memory, Intel claims it manufactured 33 million flash chips in 1993 and is geared up for 80 million in 1994. This spike in production promises cheaper, higher-capacity flash drives in the future.—*Christopher Barr*

Apple Newton: The Journey Continues

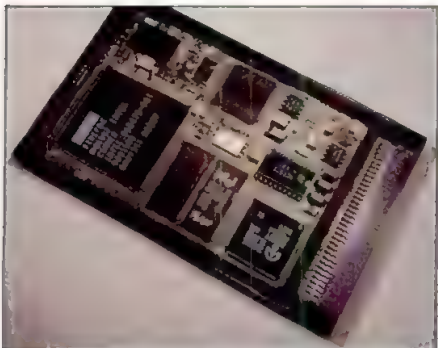
VOLTAIRE ONCE SAID, "THE BEST IS the enemy of the good." According to Gaston Bastiaens, vice president and general manager of Apple's PIE (Personal Interactive Electronics) division, the decision to launch the Newton MessagePad this past September remains true to Voltaire's words. It's clear that the Newton was a case of "too little, too early," but Apple has been making it clear that what it sold us was not just a product—it is the future.

The current spin on Newton's future de-emphasizes handwriting recognition and stresses the availability of disparate pieces that build upon the platform's potential.

There's about to be a flurry of Newton activity, including a Windows version of the Newton Connection Kit, which will allow the transfer and synchronization of data from PC to Newton, and a much-needed upgrade to the Mac Connection software.

At Comdex, Apple debuted Newton Mail, an ambitious new service that will offer multimedia mail. In an effort to make the Newton your main "mail machine," Newton Mail includes gateways to Internet, America OnLine, and CompuServe. A sorely missed PCMCIA card with a 2,400-bps modem is now available, and a wireless messaging service delivered by MobileComm (a subsidiary of Bell South) lets Newton act like a "smart pager." The service relies on a credit card-size receiver that can operate stand-alone or in the Newton's PCMCIA slot.

And the family is about to breed. Two



Intel and AMD are ramping up production of flash memory chips, which, unlike DRAM, retain information in silicon even with no power.

Top Retail Software

Current ranking	Last issue	Product, company
1	—	MS-DOS 6.2 Upgrade Kit Microsoft Corp.
2	5	Quattro Pro 5.0 for Windows Borland International
3	11	Microsoft Windows 3.1 Microsoft Corp.
4	3	Quicken 3 for Windows Intuit
5	2	QEMM 7.0 Quarterdeck Office Systems
6	12	Microsoft Excel 4.0 for Windows Upgrade Kit Microsoft Corp.
7	8	Procomm Plus 2.01 Datastorm Technologies
8	—	QuickBooks 2.0 for Windows Intuit
9	—	WordPerfect 6.0 for DOS WordPerfect Corp.
10	—	WinFax PRO 3.0 Delrina Technology
11	—	Microsoft Publisher 2.0 Microsoft Corp.
12	—	Microsoft Windows for Workgroups 3.1 Microsoft Corp.
13	6	Quicken 7 for DOS Intuit
14	—	Quattro Pro 5.0 for DOS Borland International
15	—	The Norton pcAnywhere 4.5 Symantec Corp.

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending October 30, 1993. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a picture of the entire software market. Sales information compiled by Ingram Micro.

new members—the larger-display Newton Professional and the Siemen NotePhone (a Newton with a phone appendage much like the one on AT&T's EO)—will be launched early this year. And on the software front, a \$795 Newton Toolkit that takes word-processed content and turns it into a Newton app should help get Newton titles to market. So far, Newton titles, available on ROM cards or via transfer from floppy disk, are clever adaptations of handy pocket apps.

Whether or not Apple should be charging us as much as they do to play in this long-term beta test is matter for debate, but when you look at this lineup, Apple's momentum toward fulfilling Newton's promise seems fairly undebatable.—*Robin Raskin*

Out of Hibernation

IN COMPUTER DESIGN, TECHNOLOGY traditionally moves from the desktop to the notebook. Now, a feature known as standby, hibernation, or resume mode, which was first engineered into notebooks to save power, is making its way to the desktop.

Hibernation lets you power down your system without closing your applications, then pick up where you left off the next morning. By putting your system into suspend mode at night and resume in the morning, you can bypass that same boring boot routine every morning.

IBM is the first major player to design resume mode into desktops. Its new PS/1 models are equipped with a Smart Energy System (SES) that places the computer into standby mode, which uses very little power, or resume mode, which uses no power.

IBM implements SES through a combination of IBM-developed hardware and power-aware system software. A chip watches for certain signals from your applications or operating system. After a user-specified period of inactivity, SES invokes the standby mode, slows the hard disk, and sends VGA signals to the monitor to blank it. In this state, the system consumes only a trickle of power to save the CPU registers and awakens when you press a key.

In resume mode, which you can use overnight, SES writes an image of your open applications, RAM, and processor registers to a file on-disk and turns off the power supply. When you turn the power on, the system quickly reads the image file and you're back in business exactly where you left off.

PC&C Research Corp.'s Iguana Series (805-484-1685) takes a different approach by using a PicoPower chip set and the System Management Mode (SMM) found in many 486 chips. Iguana provides 24 hours of battery backup in case you have a power failure.

There are also a few software-only solutions, including Stop & Go!, Fantastic Recall, and PC Tools for Windows. But none have the elegance of IBM's PS/1 or PC&C Research's Iguana.—*Christopher Barr*

The Painful Move To Paid Support

IF 1993 WAS THE YEAR OF CHEAP Software, 1994 will be the Year of Expensive Tech Support. Drastic price reductions, a

THE INTERNATIONAL INTERNET ASSOCIATION

is offering free Internet access through its master node in Washington, D.C., in order to "promote the free flow of information and ideas without regard to position or affiliation." For a new account ID, call 202-387-5445 or fax 202-387-5446.

WHAT'S AS SMALL AS A MATCHBOOK,

holds 80MB of data, and slips *inside* a PCMCIA card? It's SyQuest Technology's SQ1080, the first PCMCIA removable hard disk cartridge drive with removable media. A representative from SyQuest says the company expects that by sometime in mid-1994, the 1.8-inch cartridge drive will be available on notebooks and on PDAs with PCMCIA Type III slots.

more complex computing environment, more product introductions, and an expanding installed base are all forcing vendors to rethink their support policies. So get ready to pay.

While the price free-fall may be a boon for consumers, it's obviously cutting into vendors' profits. They're responding with a number of new support policies. You're likely to be charged for calls and offered pricey extended support programs. Meanwhile, vendors are farming out tech support to third parties in order to handle the spike in calls and to control costs.

Expect to hear vendors speak of "fee-based" and "value-added" support in the same breath. For example, WordPerfect will maintain its traditional toll-free, free support, but it's now offering two special support plans for corporate customers who can afford the \$10,000 and \$15,000 prices. They include guaranteed 4-hour response, 24-hour 7-day-a-week phone support, and diagnostic tools.

Microsoft, which handles 60,000 inquiries over phone and BBS each day, continues to offer free support for its desktop

Briefs

COMPUTERS FOR CLASSROOMS WANTS

your PC. This umbrella organization will donate your PC, software, and peripherals to schools and get you a tax deduction. Participating groups include: Gifts in Kind America (800-862-4438), The East-West Education Development Foundation (617-542-1234), and the National Cristina Foundation (800-274-7846).

ANOTHER GOOD REASON FOR MULTIMEDIA

In conjunction with the National Center for Missing & Exploited Children, IBM has developed an "electronic milk carton" kiosk display with full-motion video and and interactive touch-screen to present late-breaking missing child alerts. The kiosk will debut in Washington's National Airport. Plans are to expand to major airports nationwide.—*Carol Levin*

apps, but offers only 90 days of free support for its operating system, and a fee-based program for advanced systems. Call on the weekend and you'll pay \$2 a minute.

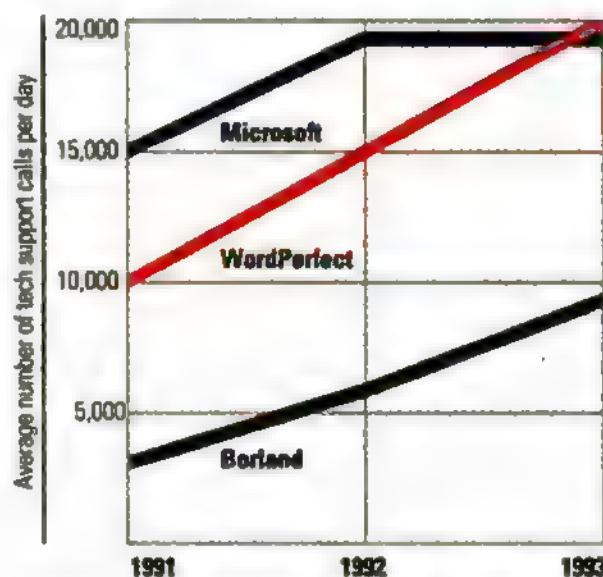
The transition is creating a new growth industry as vendors farm out support and as high-tech spreads into rural areas where labor and location costs are lower. Support companies include AGS in Atlanta, Corporate Software in Cambridge, National Tech Team in Dearborn, Michigan. Software Support in Heathrow, Florida, and Sykes Enterprises (SEI) in Sterling, Colorado.

"In the last year, interest from software companies has increased. They're realizing

that to be competitive, they have to turn their resources to development," says Amy Milligan, manager of client support services at AGS. "They've made a strategic decision that they're not in the support business but in the development business," she adds. AGS added over a hundred employees last year, and SEI is building another call center where 300 people will answer the phones.—*Carol Levin and Lance Ulanoff*

Queuing Up for Tech Support

Industry-wide call volume has increased 37 percent over the past year. The average call length is 12 minutes, and the average time on hold is 6 minutes.



Sources: Borland, Dataquest, Microsoft, WordPerfect; figures do not include BBS calls.

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- Windows-accelerated PCI local bus SVGA color graphics card.
- ZEOS 15" 1024 x 768 NI SVGA color monitor, .28mm dot pitch.
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- Ten-bay vertical case with two cooling fans.
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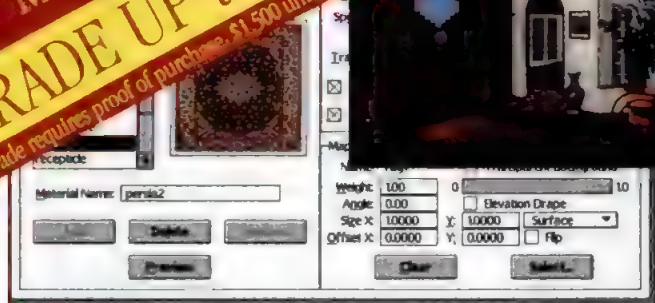


CIRCLE 125 ON READER SERVICE CARD

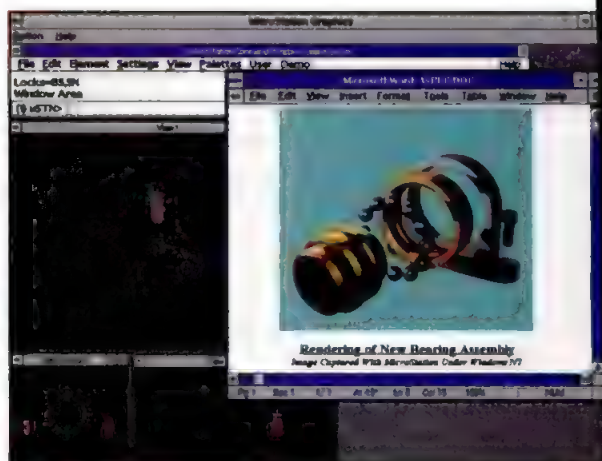
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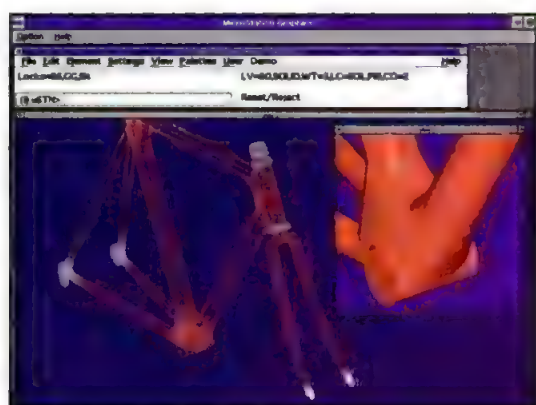


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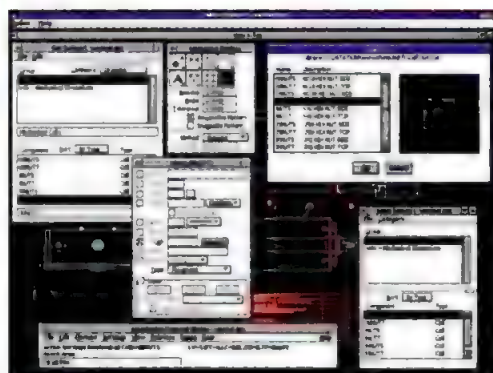
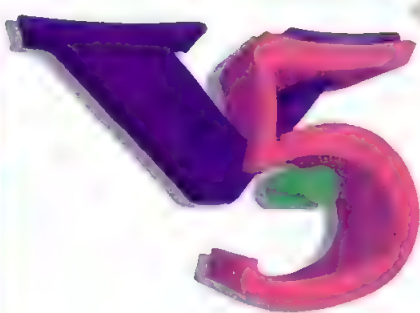
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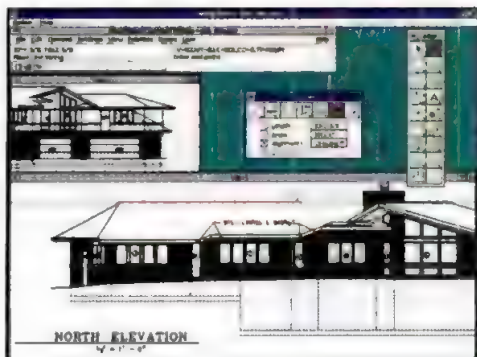
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Undo/Redo Commands. Undo mistakes and perform “what-if” designs in a flash with unlimited undo and redo. **Plotting.** Plot raster and vector information by view or defined areas, at any scale. Visually preview the plot before plotting, saving time and materials. **Online HELP.** MicroStation's

HELP remains active, tracking the command you're currently using, so there's no searching through manuals for assistance. **Associative Patterning and Hatching.**

Associate patterning with graphics. Change graphics and the

patterning updates. Flood-fill hatching/patterning intelligently fills an area, detecting boundaries and holes with a single pick. **Associative**

Dimensioning. Dimensions are associated with the geometry, not with a point in space, so that when you change

the geometry, the dimensions automatically update. **Custom Line Styles.**

Create space-saving custom line styles and place railroad tracks, trees, isobars – anything – just as you would place a line.

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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Microsoft Ships a Quick Upgrade

MS-DOS 6.2 Addresses DoubleSpace Concerns, Adds Features

BY JEFF PROSISE

Despite record-setting sales (more than 5 million upgrades and 10 million OEM copies shipped since March 1993), Microsoft's MS-DOS 6.0 has been plagued by rumors and innuendo concerning the safety of its built-in disk compression software, DoubleSpace. Microsoft addresses these concerns and more in Version 6.2, its latest upgrade to the operating system that drives approximately 100 million PCs worldwide.

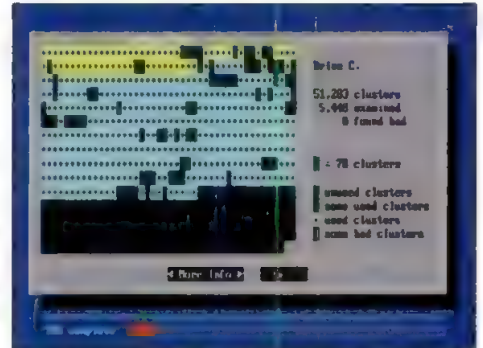
MS-DOS 6.2 was christened

6.2 instead of 6.1 to avoid confusion with IBM's PC-DOS 6.1 (the IBM version of MS-DOS 6.0 with some IBM-added extras). It is available in three forms: the \$77.95 MS-DOS 6.2 Upgrade, the \$77.95 MS-DOS 6.2 Upgrade for Dummies (the MS-DOS 6.2 Upgrade with a special edition of IDG's best-selling book *DOS for Dummies* thrown in), and the \$9.95 MS-DOS 6.2 Step-Up.

Upgrade and Upgrade for Dummies will upgrade any version of MS- or PC-DOS from Version 2.11 up. Step-Up will

upgrade only a system that is currently running MS-DOS 6.0.

All three products are upgrade kits, incapable of installing MS-DOS on a hard disk that doesn't already contain a version of MS- or PC-DOS. The Step-Up package doesn't include a user's manual, because the manual is unchanged since 6.0. Microsoft has also made Step-



A CLOSE LOOK: MS-DOS 6.2's new ScanDisk utility replaces good old CHKDSK.

Up available for free (other than connect charges) on CompuServe and the Microsoft Download Service.

■ New Batch Language, PIM, Defragger

Norton Desktop 3.0 Overhaul Results in One Great Utility Bundle

BY BARRY SIMON

Version 3.0 of Symantec's \$179 Norton Desktop for Windows (NDW) is a major upgrade of the popular Windows utility collection. Among the new components you'll find are enhanced file open/save dialog boxes for some of your Windows apps, a mini-PIM, a slick configuration utility, Windows versions of the Norton Disk Doctor and defragger, and a powerful new batch language.

Components held over from Version 2.0 have all been upgraded. Especially significant are new SCSI tape support in the

backup utility, the handling of .ZIP files in the File Manager, the ability to copy to the clipboard from file viewers, and a Smart Erase mode that tracks recently deleted files in RAM.

All the other components—Launcher, Text Editor, Anti-Virus, Sys-Info, Screen Saver, Scheduler, Calculators, Icon Editor and SuperFind—have been enhanced, too.

FILE ASSIST

NDW's enhanced file dialog boxes will quickly become such an essential part of your computing that it will be difficult for you to imagine how you ever coped without them.

The File Assist utility works with standard File Open and File Save/Save As dialog boxes.

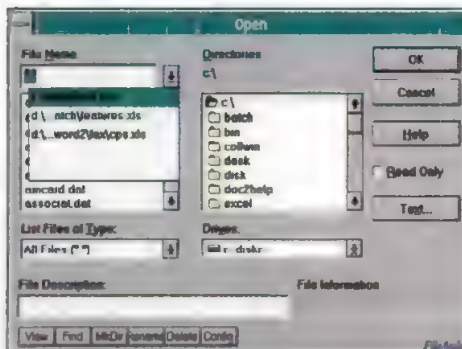
File Assist gives those dialog boxes a gray 3-D look, but that's

Continues on page 44

DEALING WITH DOUBLESPEACE

Microsoft identified two primary causes of DoubleSpace-related failures: defective sectors in the system area of a DoubleSpace volume, and misbehaved application programs that corrupted DoubleSpace's image in

Continues on page 40



FILE ASSIST: File Open and Save dialog boxes have a list of recently opened files.

IN FIRST LOOKS

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■ Microsoft Makes a Better Connection

Windows for Workgroups 3.11: The Best Windows for All?

BY FRANK J. DERFLER, JR.,
AND STEVE RIGNEY

When Microsoft introduced Windows for Workgroups into the low-cost LAN market in October 1992, it didn't make much of a splash. Microsoft's major selling point, built-in peer-to-peer networking, was the worst nightmare of many big-system managers, and its poor integration of DOS-only PCs sank the hopes of users who weren't inclined to commit to Windows. The product was in a lose/lose situation. While Windows for Workgroups had appeal beyond networking, such as 32-bit file operations, those features didn't compel buyers to go beyond the Windows 3.1 they typically received bundled with their PCs.

Microsoft listened to the market, tweaked and pruned the product, and has now released Windows for Workgroups 3.11. This release is an attractive product with serious appeal both to people with small LANs and those with extended networks. It's also the version of Windows you should run if you want to get the best performance in all operations. The company's strategic planners had their own reasons for not simply calling this product Windows 3.11, but the name Windows 3.11 would have squared better with the facts. Windows for Workgroups 3.11 is as much an improved version of Windows as it is a network operating system.

Like its predecessor, Windows for Workgroups 3.11 integrates drive sharing (including CD-ROM drives), printer sharing, e-mail, and group calendaring and scheduling into Windows. It's also the first manifestation of Microsoft At Work,

an architecture designed to integrate telephones, printers, and fax machines with Windows PCs. The network functions include notification of completed print jobs, connections to shared resources through Print Manager and File Manager, and an extensive security system. It's fast, very easy to install, flexible, and affordable.

TWO VERSIONS

You can buy Windows for Workgroups 3.11 in two versions: as a \$219.95 complete package and as an \$69.95 add-in package called the Workgroup Add-on for Windows. The Add-on for Windows gives a Windows 3.1 user all of the features of Windows for Workgroups 3.11, but costs less because it doesn't have all of the Windows files. Microsoft sweetens the Add-on deal for people who previously bought Windows for Workgroups 3.1 by including a \$10 rebate coupon.

Both the complete package and the Add-on package will update an existing Windows 3.1 system without blowing away all of your carefully configured programs and .INI files during the installation. You'll need the full Windows for Workgroups 3.11 product if you want to install and set up Windows for Workgroups 3.11 across the LAN using the the SETUP/A and SETUP/N options. The Workgroup Add-on for Windows won't upgrade a set of Windows 3.1 files to full Windows for Workgroups 3.11 capabilities across the network. In a move designed to gain corporate acceptance, both packages allow administrators to disable the server functions.

A separate \$49 product called Microsoft Add-on for MS-DOS brings a non-Windows

PC into the network as both a client and a server; it also adds Microsoft Mail, Schedule+, and shared fax capabilities. This "add-in" is, in fact, a fully capable and expandable DOS-based network operating system. The pressure on competitors like Artisoft and Performance Technology just went up another notch.

Top OEMs committed to preinstalling Windows for Workgroups 3.11 as the standard operating system on all their PCs include CompuAdd, Dell, Gateway 2000, DEC, Investronica, Texas Instruments, Toshiba, Unisys, VOBIS Microcomputer AG, Zenith Data Systems, and Zeos. Many other companies, including ALR, Compaq, and Hewlett-Packard have licensed the product and can offer it on their computers.

NETWORKING FEATURES

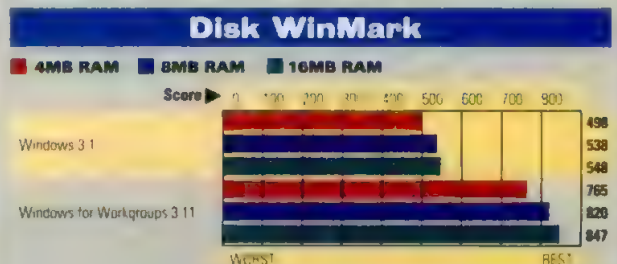
In the competition between Novell and Microsoft, Microsoft emphasizes flexibility with cross-platform and cross-operating

Benchmark Tests: Windows for Workgroups

DISK WINMARK

To test Windows for Workgroups' new 32-bit file access system, we ran the Disk WinMark test suite from WinBench 4.0. Microsoft Windows for Workgroups 3.11 easily outperformed Microsoft Windows 3.1, even when it had only 4MB of RAM to Windows 3.1's 16MB.

We used a Compaq Deskpro 486/33M with a 340MB hard disk, running MS-DOS 6.2. While increasing the memory from 4MB to 16MB, we maintained the default cache sizes for SmartDrive 5.0 except in testing Windows 3.1 with 16MB of RAM, when we increased the SmartDrive cache to 4MB to match the 32-bit file access cache in Windows for Workgroups 3.11.



I/O THROUGHPUT

We compared Windows for Workgroups 3.11 with the year-old Version 3.1 of the same product and found a substantial performance improvement in the new release. We also compared Version 3.11 with a major competitor: Artisoft's LANtastic for Windows, Version 5.0.

Note that we ran this test with 16MB RAM in the 486/33 that acted as the server. When we ran the test with 4MB RAM in the server, the throughput for Version 3.11 dropped to 0.4 megabits per second, proving that the added memory is vital to performance. We did not use Windows' SmartDrive disk cache or DOS 6.0's DoubleSpace disk compression on the server. For client computers we used 386/33-based systems with 4MB RAM and NE-2000 LAN adapters.



First Looks

system capabilities, while Novell grows stronger centralized systems. As a network operating system, Windows for Workgroups almost overwhelms you with diversity. This version of the product even includes a cunning blend of Microsoft's client/server software with Novell's IPX network transport software, allowing savvy managers to use inexpensive and widely available routers on Windows for Workgroups and Windows NT extended networks. The SMB/IPX software for Windows NT isn't available yet, but it's on the way.

In its simple default installation, Windows for Workgroups uses the Microsoft System Message Block (SMB) over the NetBEUI network transport protocol. This is the native protocol for Windows NT, and Windows for Workgroups is the natural client for NT servers. You can start networking with only Windows for Workgroups and then integrate NT servers as you need them.

The network communications software runs over Microsoft's NDIS adapter driver, and NDIS allows multiple protocol stacks on one adapter, so you can load third-party client software for Banyan's VINES, Digital's Pathworks, Sun's PC-NFS, and Artisoft's LANtastic and map DOS drive letters to servers from each of those systems. Microsoft makes TCP/IP available practically for free; an unlimited site license for "TCP/IP for Windows for Workgroups" sells for \$49.95, and Microsoft has just made the software available on CompuServe and the InterNet.

NETWARE CONNECTIVITY

Getting NetWare connectivity is a little more complex. Microsoft includes a 32-bit protected-mode IPX driver called NWLink. You can run the Microsoft SMB redirector and server software over NWLink instead of NetBEUI to take advantage of low-cost IPX routers (like the router built into NetWare) and other IPX services such as

Microsoft Windows for Workgroups: Selected Features

	Microsoft Windows for Workgroups 3.11	Lotus 1 for Windows 5.0	Microsoft Windows with NetWare Client 3.1
Network configuration	Peer-to-peer	Peer-to-peer	Client/server
List price	\$69.95 per node	\$100.00 per node	Depends on setup
Uses NDIS drivers	☒	☒	☐
Uses ODI drivers	☒	☒	☐
CD-ROM sharing	☒	☒	☐
RAM requirement for client	5K	27K	72K (with ODI and Net2000)
Windows GUI integration	Excellent	Good	Fair
Acts as client to DOS servers	☒	☒	☒
Acts as server to Windows and DOS clients	☒	☒	☐
Built-in fax sharing	☒	☒	☐
Built-in e-mail	☒	☒	☐
Built-in scheduling	☒	☐	☐
Password security	☒	☒	☐

client/server programs, including Microsoft SQL Server, and Lotus Notes.

But Microsoft doesn't provide the NetWare client software, and NWLink doesn't work with Novell's NETX.EXE redirector, so you must install the Novell client software that comes with the NetWare server software. You should install the NetWare software before installing Windows for Workgroups so the Microsoft program can pick it up and make it part of the automatic network installation process.

YOUR CHOICE

Microsoft isn't stuck on NDIS. You can run a full NetWare protocol stack using all of the NetWare client software, including the Novell ODI network card driver, the NetWare real-mode IPX stack IPXODI.COM, and the NetWare redirector NETX.EXE. Microsoft provides Windows for Workgroups drivers for ODI, so if you combine NetWare and Windows NT, for example, you would typically use only ODI drivers.

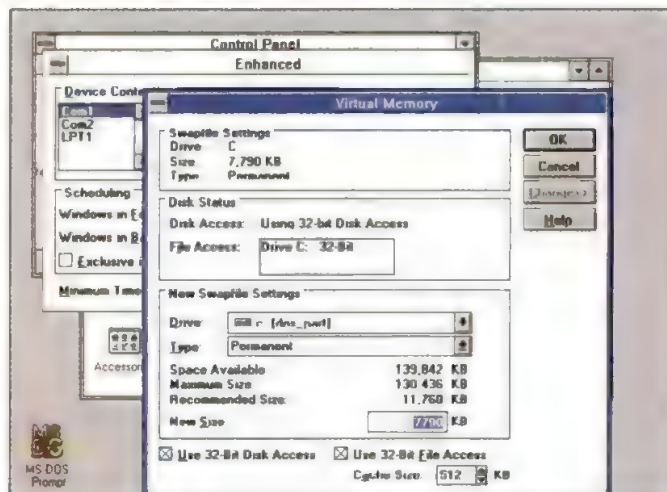
During our network testing, we found that flexibility can be the enemy of simplicity. If you just want to use SMB over NetBEUI, or even SMB over IPX, everything is simple. But as soon as you add TCP/IP or NetWare, the level of sophistication needed to make things work goes up appreciably. Either this system of network

drivers is very simple or it's quite complex; there is no middle ground. We also found that a PC acting as a server needs at least 8MB of memory, and 16MB is better. You can run a server in a 4MB machine, but it is very slow. Similarly, on our Winstone test the score dropped noticeably, from 33 on a 16MB machine down to 19 when we tested on a 4MB machine.

fax service. At Work fax will also pass binary attachments to fax messages, such as data files or images, between other At Work-equipped devices, but until At Work catches on in fax machines, that only means other PCs running Windows for Workgroups 3.11. We found At Work fax easy to use and reliable.

Microsoft also includes client software for the Remote Access Server (RAS) feature built into Windows NT Advanced Server. This software connects to NT Advanced Server through a modem and creates the remote-node type of connection (in contrast to remote control) that is useful for e-mail and client/server computing.

This new version of Windows for Workgroups has a lot of value to offer people who want to set up small networks, and a lot of room for growth for those with more ambitious plans. It makes a great platform for standalone or networked computing.



FAST FILES: Windows for Workgroups has new 32-bit file access capabilities that result in better network throughput.

At the user level, Microsoft's At Work fax provides more capability than many dedicated fax programs. You can use Microsoft Mail, included in the package, to create messages with mixed e-mail and fax addressees, and At Work fax will move the images out through an attached fax modem. Any Windows program can print to the At Work

• List price: Microsoft Windows for Workgroups, Version 3.11, \$249.95; Workgroup Add-on for Windows, \$99.95; for DOS, \$49.95. Requires: 3MB RAM, 7MB hard disk space, DOS 3.3 or later. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400; 206-882-8080.

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DOS 6.2

CONTINUED FROM PAGE 37

memory. Both problems are addressed effectively in 6.2. DoubleSpace now features a technology called DoubleGuard, which checks DoubleSpace code and data at critical junctures and halts the system if either has been corrupted. According to Microsoft, DoubleGuard penalizes performance by only about 2 percent, and can be disabled altogether if you wish.

The second safety-related DoubleSpace enhancement is the new ScanDisk utility, which DoubleSpace's install program uses to check the surface of the host drive for physical defects before creating a compressed volume. ScanDisk can also be used from the command line to diagnose and repair disk errors. It does everything that CHKDSK does and a lot more, including "hotfixing" defective sectors (flagging them as defective and moving the data stored in them to nondefective sectors), repairing cross-linked files, and repairing damaged Compressed Volume Files—the files from which compressed drives are created.

MORE DOUBLESPEACE IMPROVEMENTS

Other DoubleSpace enhancements include error messages that are more descriptive, an auto-mounting feature that mounts compressed floppy disks when they are inserted, and an Uncompress option that uncompresses compressed drives and removes DoubleSpace from your hard disk—an important feature that was missing from MS-DOS 6.0.

Uncompress works only if the files on the compressed drive will fit on the uncompressed host drive. If all of your files don't fit,

it's up to you to delete some of them prior to running Uncompress.

The price you pay for these features is memory. DoubleSpace's footprint in memory went from about 43K in MS-DOS 6.0 to 52K in 6.2. However, you can conserve 4.5K of conventional memory by disabling auto-mounting. Also, a portion of MS-DOS 6.2's DoubleSpace driver loads in the HMA when space permits, reducing its in-memory footprint to about 34K with auto-mounting off. DoubleSpace can still be moved to

upper memory on PCs with 386 processors or better, reducing its size in conventional memory to 0K.

SMARTDRIVE ENHANCEMENTS

SmartDrive has also changed. Write-behind caching, which improves performance but can lead to data loss if a PC is powered off at the wrong moment, can now be disabled with a /X switch. The MS-DOS 6.2 setup program adds a /X switch by default to new installations. When write-behind caching is enabled, the new SmartDrive flushes its cache whenever the MS-DOS prompt is displayed unless instructed not to. And SmartDrive now caches

What Else Is New in DOS 6.2?

- An interactive boot option lets you step through your AUTOEXEC.BAT and CONFIG.SYS files a line at a time.
- COMMAND.COM's new /Y switch lets you run batch files interactively, executing them one line at a time and skipping lines if desired.
- The startup key combination Ctrl-F5 performs a clean boot without DoubleSpace.
- Commas are now used to make large numbers more readable in the output from the DIR, MEM, CHKDSK, and FORMAT commands.
- A new DISKCOPY command uses hard disk space for temporary data storage to eliminate disk swaps.
- DEFRAG has been upgraded to handle disks containing about twice as many files (up to 20,000) as before on systems containing XMS memory.
- The MOVE, COPY, and XCOPY commands prompt you before overwriting files at the destination when they're issued from the command line.
- HIMEM.SYS tests extended memory and notifies if you if you have a bad RAM module. This option can be disabled by starting HIMEM.SYS with a /TESTMEM:OFF switch.
- DOS 6.2 lets Windows for Workgroups 3.11 users operate in Fast File Access mode (full 32-bit I/O).—Jeff Prosser

CD-ROM drives, boosting their performance by 15 to 150 percent. In anecdotal testing, we found drive performance boosted by as much as 500 percent.

Unfortunately, Microsoft didn't see fit to upgrade MS-DOS in two key areas that needed upgrading. DEFRAG still won't defragment a compressed volume as thoroughly as the Norton Utilities 7.0's Speed Disk does, defragmenting files at the FAT level but not at the sector level. And MemMaker still doesn't

handle CONFIG.SYS files set up for multiple configurations.

Who needs MS-DOS 6.2? You do, if you're currently running 6.0. Step-Up is so inexpensive that the benefits easily outweigh the cost of upgrading, and 6.2 is a better—and safer—operating system than 6.0 by any measure. You should also seriously consider an upgrade if you're running an earlier version of MS- or PC-DOS and could make use of such features as on-the-fly disk compression, automatic memory optimization, virus protection, CD-ROM caching, and tighter integration with Windows. For an anticipated street price of about \$50, MS-DOS 6.2 is one of the better bargains in software today.

• List price: *MS-DOS 6.2 Upgrade*, \$77.95; *MS-DOS 6.2 Upgrade for Dummies*, \$77.95; *MS-DOS 6.2 Step-Up*, \$9.95. Requires: 512K RAM, 6MB hard disk space (full installation), DOS 2.11 or later (Step-Up requires MS-DOS 6.0). Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080.

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If you have a licensed copy of MS-DOS 6.0, you can download and install the MS-DOS 6.2 "Step Up" upgrade from ZiffNet. For more information and to download the file, type "GO DOS-UPGRADE" at any CompuServe I prompt.

MSDOS62	15,040	(15K)	0	(0K)	15,040	(15K)
MSCDEX	40,624	(47K)	0	(0K)	40,624	(47K)
SMARTDRV	38,368	(38K)	0	(0K)	38,368	(38K)
DOSKEY	4,144	(4K)	0	(0K)	4,144	(4K)
UNHFILES	1,920	(2K)	0	(0K)	1,920	(2K)
Free	686,592	(592K)	559,952	(547K)	46,640	(46K)

Type of Memory	Total	Used	Free
Conventional	655,360	95,400	559,952
Upper	154,496	107,856	46,640
Reserved	0	0	0
Extended (XMS)	15,588,688	2,335,872	13,172,736
Total memory	16,310,464	2,539,136	13,779,320
Total under 1 MB	809,856	203,264	606,592

Largest executable program size	559,956	(547K)
Largest free upper memory block	41,456	(40K)

MS-DOS is resident in the high memory area.

FINALLY! Commands such as DIR and MEM now use commas.

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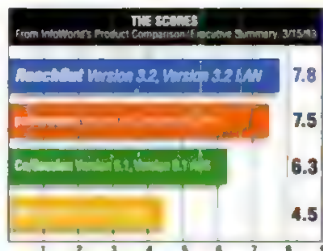
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■ Operating Systems

OS/2 for Windows: IBM Targets Windows Devotees

BY AMARENDRA SINGH

Following the recent expiration of IBM's licensing agreement with Microsoft Corp. to include a modified version of Windows with its OS/2 operating system, many wondered aloud where OS/2 would go from here. IBM's emphatic answer? Forward, of course. The introduction of IBM's OS/2 for Windows (sans any and all Microsoft Windows executable and source code) is IBM's way of making lemonade.

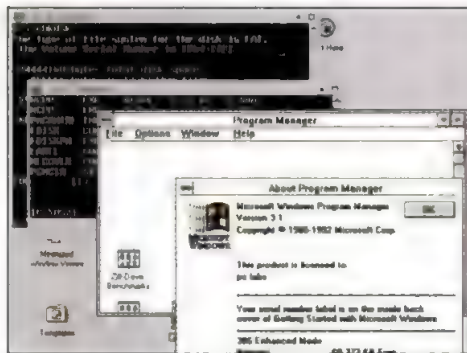
OS/2 for Windows is designed to run on systems that already have Windows installed. IBM created this version by removing all the Windows binaries from the system (see the sidebar "How IBM Did It") and using a modified Virtual DOS Machine (VDM) to run the pre-installed Windows. This VDM, which already provides DOS compatibility to OS/2, has been altered to run Windows 3.1 in Enhanced mode.

A NEW APPROACH

While OS/2 2.1 already has an upgrade price for Windows users, this is the first time it has been positioned to work as a Windows enhancement. End users who already use Windows are now presented with the option of trying OS/2 without giving up or changing their existing environment.

In terms of OS/2 features and com-

patibility, this version is completely equivalent to the standard version of OS/2 2.1 currently available on the market. (There are no slipstream upgrades or bug fixes here.) IBM



OS/2 FOR WINDOWS: It's ready to run with your existing Windows applications.

has done this in order to simplify support needs for organizations currently running or upgrading to OS/2 2.1.

OS/2 for Windows can also be installed on a system without Windows, as long as the user will be using only DOS and native

OS/2 applications. Installing Windows later should present no problems, and the operating environment will be integrated into the system in much the same way that Windows integrates with other OS/2 versions. The included Multimedia Presentation Manager/2 (MMPM/2) is also the same as the one used in OS/2 2.1.

All told, without the modified Windows environment, the system is down to 11 disks, plus disks for video and printer drivers, and, like OS/2 2.1, it still includes two floppy disks for MMPM/2. IBM has also included drivers for the popular S3-based video cards.

SAME-O, SAME-O

Since the installation procedure remains the same, the problems that many users have reported when installing OS/2 will also remain.

This is an area that IBM will certainly need to work on if it wants to expand its presence in the retail market. For those who want to remove OS/2 for Windows, IBM will also provide an uninstall procedure that can be downloaded from its BBS, although a DOS boot and deletion of certain

doesn't need to modify or even touch the Windows source code.

Thus, when you launch a seamless or full-screen session of Windows 3.1 or one of its applications, you are simply launching an IBM-DOS 6.1 session. OS/2 for Windows does a good job of maintaining tuning parameters and keeping them consistent with other OS/2 setup screens.

Despite these modifications, OS/2 is still unable to run 32-bit Virtual Device Drivers (VxD), so the applications that use them will still not run under OS/2. Nor does OS/2 for Windows support Windows for Workgroups 3.1 or 3.11, although support for both these versions and future versions of Windows is still being considered.—AS

FACT FILE

OS/2 for Windows

IBM Personal Software
Products Division, 11400
Burnet Rd., Austin, TX 78758;
800-342-6672

List price: \$49 (\$39 for CD-ROM) until February 9, 1994; \$149 (\$139 for CD-ROM) thereafter.

Requires: 386SX-based PC or better, 4MB RAM (6MB RAM recommended), 20MB hard disk space.

In short: IBM's OS/2 for Windows has no Windows in it, but it will run just fine with the Microsoft Windows 3.1 environment already installed on your system.

430 ON READER SERVICE CARD

directories and files will easily achieve the same effect.

OS/2 for Windows also works with DOS 6 Double-Spaced and Stacker-stacked drives, as long as you use Stacker for OS/2, Version 1.1, from Stac Electronics, 800-522-7822.

AGGRESSIVE MARKETING

The introductory price has been set at \$49 for a copy and \$29 for additional licenses. This price is valid until February 9, 1994; after that, it increases to \$149 for one copy and \$119 for additional licenses. IBM will also give you \$10 off of the CD version.

The code name that IBM used for this product was Feren-gi, after a character from "Star Trek: The Next Generation" who is "aggressive in going after what he wants." Certainly IBM has an aggressive marketing strategy planned. It includes print ads in both trade and consumer publications as well as television ads. Much of the campaign is aimed at an arena where OS/2 has enjoyed little success: the end user market. □

■ How IBM Did It

At the heart of OS/2 for Windows lies its ability to run with existing Windows 3.1 environment without replacing existing Windows source code. Under previous versions of OS/2, IBM modified the Windows 3.1 binaries to work with the virtual DOS machine that it had built into OS/2.

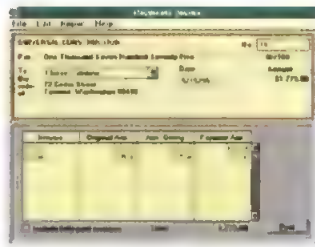
With OS/2 for Windows, the virtual DOS machine now runs an IBM-DOS 6.1-compliant version of DOS. Unlike Win/OS/2, which shipped with OS/2 2.x and let Windows communicate directly with the OS/2 operating system, Windows talks only to the virtual DOS machine in OS/2 for Windows. As a result, OS/2 for Windows



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CONTINUED FROM PAGE 37

just the start. A speed search feature lets you type in multiple letters of a file or directory name and jump right to it. A drop-down list shows the last ten files you opened in that application.

You can also get date/size information for highlighted files and type in a file description that is saved on-disk in a format compatible with Norton's NDOS and 4DOS. Five buttons are included to make a new directory (invaluable while saving a file), to call up the Norton viewers or Norton File Finder, and to rename or to delete a file.

With one exception, File Assist works only in those applications that use Windows common dialogs. Unfortunately, many major apps still don't use them, so the list of places File Assist works is spotty. In testing, it worked with Excel, Visio, all Windows applets, Procomm, WinCIM, Maple, Matlab, and many other programs we tried. While Word for Windows doesn't use the common dialogs, NDW installs macros so that File Assist still works there. Among the programs with which File Assist doesn't work are all of Borland's apps, Ami Pro, and Word Perfect for Windows.

DAY PLANNER

New to this version of NDW is Day Planner, a program that tracks appointments and has a to-do list and phone book. Though it's missing some of the bells and whistles of a full-fledged PIM, it has the basics and will be adequate for many users who don't need contact management.

You can view appointments by day, week, or month, and assign keywords and notes to them. There are alarm and recurring appointment features, and a task list lets you set and sort on priorities and track uncompleted items.

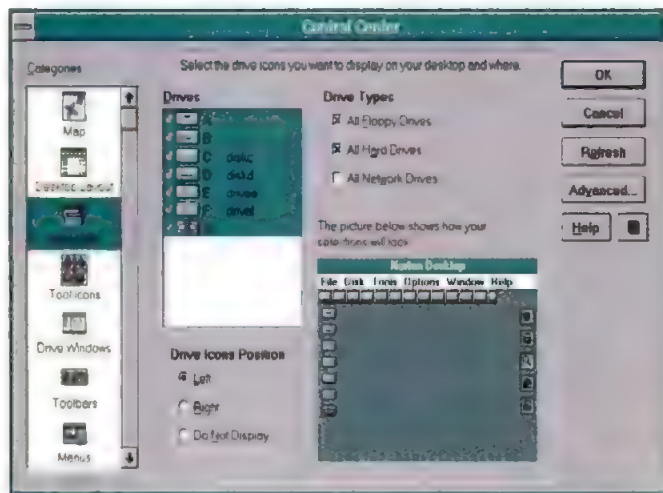
The phone book lets you store names, addresses, and

phone numbers. It's nice that you can sort on any field shown in the list view by clicking on the title of that column. Moreover, multiple-letter speed searching works in the phone book just as it does in File Assist. There is no phone dialer and no way to track incoming and outgoing calls.

NDW includes a special vir-

If you run only in Windows, you can load the Virus Alert utility as a VxD so it doesn't take any memory from DOS sessions. Or, if you sometimes work in DOS, you can load a TSR that works all the time.

The backup program has finally added support for SCSI and high-end QIC tape drives.



CONTROL: Configure the desktop using visual feedback.

tual device driver (called SymEvent) that tracks file activity for two purposes. First, you can configure a group in Quick Assist, NDW's Program Manager replacement, to display all files of a given type in a given directory. For example, all *.XLS files in a directory might appear as launchable icons. With SymEvent, newly created .XLS files would appear automatically in the group.

If you invoke SmartErase, the file recovery utility, it will first display the names of the last ten files that you deleted. It tracks these deletions in real time and remembers the file location so that recovery of files deleted earlier in a session is completely reliable.

FILE SECURITY

Taking an idea from PC Tools for Windows, the new NDW includes a Windows-based defragging utility (Speed Disk) and a Windows version of the celebrated Norton Disk Doctor. In informal testing, the defragger was especially speedy.

On our test system, the speed of SCSI backup was similar to that of PC Tools for Windows, but there were more amenities, such as letting us know what fraction of the tape was used.

NDW has added support for several new file types, most notably .ZIP files in either PKZIP 1.0 or 2.0 format. As in PC Tools, the .ZIP files are dis-

played as directories with a distinctive icon, and you can also view the compressed files inside the .ZIP files.

Text and data viewers now let you mark a block and copy it to the clipboard. This provides half of the special support that has made SCC's OutsideIn unique. Unlike OutsideIn, NDW doesn't let you print files from a viewer.

Support for graphics formats in the viewer is still weak. While .BMP, .GIF, .PCX, TIFF, .GIF, .WMF, and .WPG are supported, CGM, EPS, JPEG, and Targa are not. 24-bit .PCX files don't display at all, and 24-bit TIFF files often display an incorrect color palette.

WHAT ELSE IS NEW

The batch language, based on code licensed from Summit Software rather than the Winbatch base of the batch files in NDW 1.0 and 2.0, is new. To protect upgraders, the new batch language will use the Winbatch 3.0 code that earlier versions of NDW had, but the preferred language is the new Visual BASIC-compatible one. All the base functions from VB are supported, but not the custom controls and properties. Instead, you make dialogs with a special dialog editor. There are extensions of the language to support communication with applications, and a robust record facility. You can compile batch files and distribute them with no run-time fee.

NDW and its components are configured through a new visual Control Center that's a pleasure to use. All the components have a "treasure chest" button that pops up a list of tips to help you in that component.

NDW 3.0 proves that users benefit when strong competition keeps developers jumping. NDW 2.0 was a good upgrade, but it was neither exciting nor spectacular. NDW 3.0 follows the first release of PC Tools for Windows, and this time it leaps ahead with utilities that any Windows user will treasure. □

FACT FILE

The Norton Desktop 3.0 for Windows

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014;
800-441-7234, 503-334-6054;
fax, 503-334-7474

List price: \$179; upgrade, \$49.

Requires: 4MB RAM, 5.5MB hard disk space, Microsoft Windows 3.1.

In short: This most popular of Windows utility collections gives you several new spectacular reasons to want it—most notably File Assist, which vastly improves on the Windows Common Dialogs for File Open and Save.

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CIRCLE 226 ON READER SERVICE CARD

■ Diagramming allClear: Flowcharting Muscle Through Scripting

BY DAVID DEJEAN

Clear Software's allClear is at last in Windows, where it has always belonged. One result should be to help flowcharting get past its arcane reputation as a programmer's plaything, and help it find a place as a more widely used graphics tool.

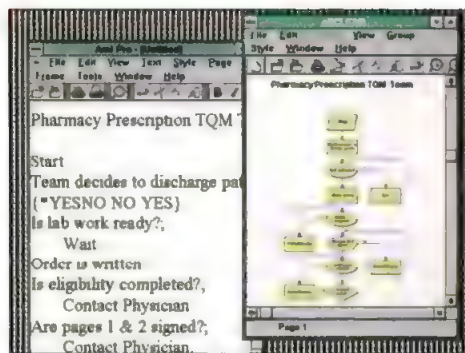
When the \$299 allClear was first introduced as a DOS-based program, its script-driven ap-

proach to creating complex box-and-line diagrams like flowcharts and organization charts was recognized as being uniquely powerful, but the limitations imposed by DOS were obvious.

The new allClear for Windows, Version 2.0, tackles those problems head-on. allClear gets the graphical environment it always needed, with a side-by-side display of the script and the diagram. The ease of TrueType

replaces the clumsiness of downloadable fonts. And with Windows' graphics functions and allClear's very limited set of drawing tools, you can turn plain charts into presentation pieces by adding clip art and text annotations, manually drawing boxes and lines, and changing colors and fonts.

Yet this more graphical allClear hasn't given up any of the strength of the text-based script-



SEE CLEARLY NOW: Windows makes it easy to work on an allClear script.

ing. You start by creating a text list of the major points in the diagram, then apply the program's grammar or punctuation marks and indentation. The program interprets this script file and produces a chart faster and better than any user working with a drawing package could. This should be especially good news in businesses where "Total Quality Management" programs have created a demand for flowcharts; allClear does all the standard TQM chart formats.

Unfortunately, allClear doesn't provide much support for creating a script. Its text editor includes some templates to paste into text, but it's underpowered and its inability to wrap text within its window is annoying. Windows helps by making it easy for you to work in any other editor.

allClear's reliance on scripts means this is not one of those Windows programs you can run simply by rooting around in the menus. You have to learn the script language. Fortunately, there's not much that a couple of hours with allClear's very brief, very good, manuals can't convey, and the quality of allClear's results belies the relative ease with which they are produced.

A special network version of the product called Instant Recall Office comes with MAPI and VIM hooks that let you notify others of upcoming tasks or meetings via your network e-mail. Users of the standalone version can log in as licensed users of the network version.

• List price: *Instant Recall 2.1 for Windows*, \$129; upgrade, \$59.95; multiuser versions available. Requires: 2MB RAM, 3MB hard disk space, Windows 3.1. Chronologic Corp., 5151 N. Oracle, #210, Tucson, AZ 85704; 602-293-3100; fax, 602-293-0709. Circle 417 on reader service card

■ Personal Information Management Instant Recall: Worth the Windows Wait

BY DON WILLMOTT

Chronologic Corp. took its own sweet time in bringing its \$129 Instant Recall PIM to Windows, but users of the DOS version who've been waiting to switch over are being rewarded for their patience.

Instant Recall 2.1 for Windows features very well-designed daily, weekly, and monthly calendars, and icons and mouse moves help you through the program's powerful attributes.

From the totally customizable button bar to the control you get over screen fonts, Instant Recall is quite at home in Windows. You can open multiple windows and drag items from one to another, and there's

one especially nice touch: The address books and calendars have indexes attached to their scroll bars. When you scroll down, the alphabet (or list of dates) flashes by, and you can stop when you approach the entry you're looking for.

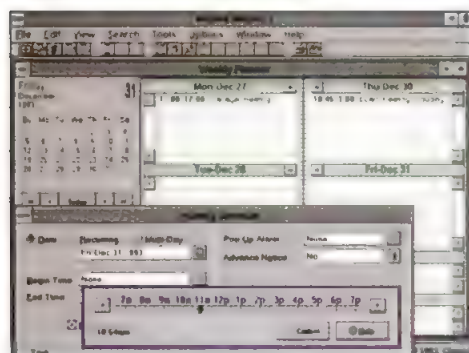
Instant Recall's unique talent is its ability to search any part of the program—scheduler, address book, to-do list—for any text string or item. To accommodate that style of information access, almost every screen gives you plenty of room in which to type free-form notes.

If you want to use the program as a contact manager, for example, you log your calls as notes to address-book entries.

The searching tools are accessible in the Windows version through either icons or keystrokes, and although it's slower



From December 20 through December 24, you can download a demo of Instant Recall for Windows or discuss it on-line with Don Willmott and Chronologic's Linda Pettay Weed. Type GO EXEC from any CompuServe prompt.



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Scanners

Speed Up, Price Down: Newest HP ScanJet Is a Winner

BY LORI GRUNIN

Scanner buyers, take notice. Hewlett-Packard Co.'s HP ScanJet IIcx improves on the quality and speed of its predecessor, the HP ScanJet IIc, at a bargain price of \$1,179—25 percent less than the price of the IIc.

The IIcx doesn't represent a great leap forward from the IIc. It still scans 24-bit color in a single pass at an optical resolution of 400 dots per inch (up to 1,600 dpi with hardware interpolation) on page sizes up to 8.5 by 14 inches. But it does have some subtle and not-so-subtle enhancements to attract scanner buyers.

The first improvement you encounter is the jumperless installation; it automatically checks for free memory addresses, and you configure the bare-bones NCR-based SCSI adapter via software. If you have other SCSI devices in your system, you'll have to change the SCSI ID on the unit manually. Although the IIcx ships with an

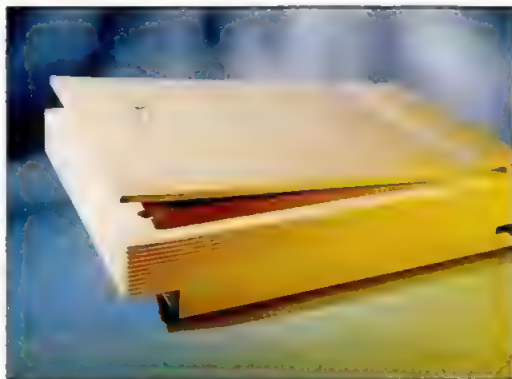
NCR-compatible CAM (Common Access Method) driver, the system also supports the more common ASPI (Advanced SCSI Protocol Interface).

Getting the IIcx up and running takes about 20 minutes if you know your way around similar types of hardware. That time includes the installation of DeskScan II, the scanning utility that accompanies the IIcx and acts as its Twain driver. The ScanJet IIcx bundle also includes Aldus PhotoStyler SE, a "special edition" of PhotoStyler 2.0 that lacks some of the high-end facilities of the regular version, such as image processing filters and 8-bit masks.

You'll notice the other enhancements once you start scanning. The IIcx is faster than the IIc, or faster than any similar scanner in this price category; on our speed tests, it had a through-

put of about 166K per second, compared with transfer rates of 133K per second and below for comparable products. That translates to about 11 seconds for a 400-dpi page of text, though HP claims the scanner can scan as fast as 8 seconds per page.

HP has also expanded the tonal range of the unit, but uncalibrated scans are a bit dark. We could distinguish 32 gray steps in a screen-calibrated RGB scan, versus 28 with no calibration. The color balance is a bit off as well. For each pixel, the scanner will record the red value darker than the green value and the green darker than the blue.



HP SCANJET IIcx: Flatbed color scanning bargain.

So neutral grays, for example, have a slight orange cast. This means your uncorrected images will appear slightly warmer than the originals; they're extremely attractive but not entirely color-accurate. Only prepress professionals will consider this a problem, and the effect can be minimized by careful calibration and correction.

SOFTWARE UPDATES

Other changes have taken place in the IIcx's software. Version 2.0 of AccuPage, HP's software/firmware combination for improving performance with optical character recognition (OCR) software, now includes the ability to optimize text and graphics in a single pass, promises increased ADF (automatic document feeder) throughput, and potentially enhances recognition of text as small as 4 points. Most OCR packages will be

supporting AccuPage 2.0, including the forthcoming update to Caere Corp.'s OmniPage Professional. Owners of the HP ScanJet IIc and IIp who upgrade their versions of DeskScan can take advantage of AccuPage 2.0 support.

DeskScan II is a well-designed utility that allows you to make numerous changes and corrections on the preview scan so that they can be applied to the final scan. This real-time feedback eliminates the time-consuming and tedious process of scanning and rescanning to try different settings. DeskScan II also offers image optimization

tools, such as the ability to target the most important highlight and shadow areas to preserve, gamma curve adjustment, and hue and saturation control.

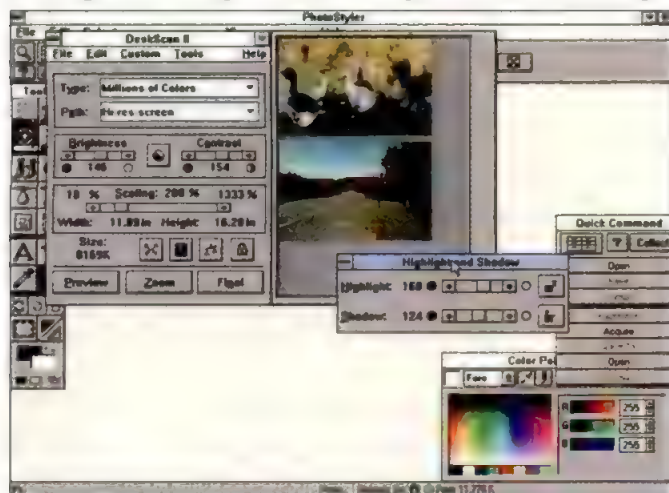
The program now includes more automatic features for one-step scanning. You get automatic preview on program load, image type identification, and auto-image find. HP has also updated Desk-

Scan II to support the optional automatic document feeder (the IIcx uses the same \$559 feeder as the IIc) and a new \$759 transparency adapter expected to ship in January that handles sizes from 35-mm slides to 8.5-by-11-inch sheets. The document feeder and transparency adapter are a breeze to install, thanks to the IIcx's screwless design, and both operate smoothly.

Though current IIc owners shouldn't feel that they're missing anything, Windows users looking for a great color flatbed scanning value should be more than happy with the HP ScanJet IIcx.

• List price: **HP ScanJet IIcx**, \$1,179; **automatic document feeder**, \$559; **transparency adapter**, \$759. **Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051; 800-722-6538, 208-396-2551.**

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486DX2-50	\$1695	486DX2-50	\$1995	486DX2-50	\$2295	486DX2-50	\$2795
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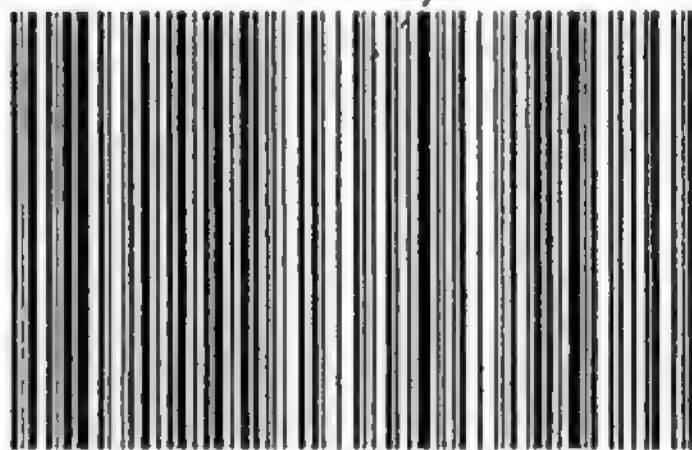


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1. Follow instructions on the other side

Back

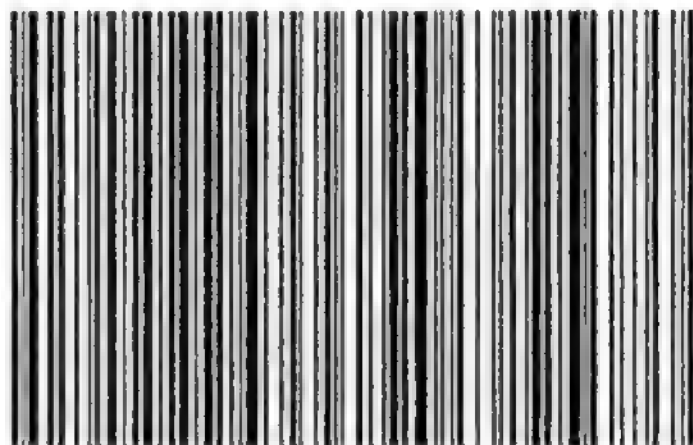
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Inverted Back

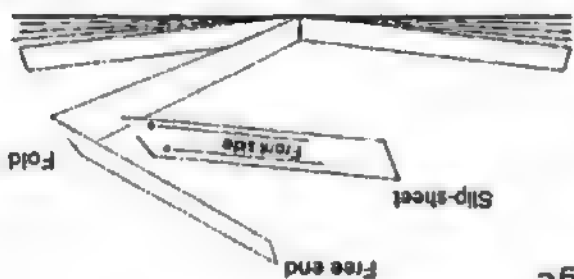
1. Follow instructions on the other side

Folded edge of the page



Inverted Foldout slip-sheet

Foldout slip-sheet

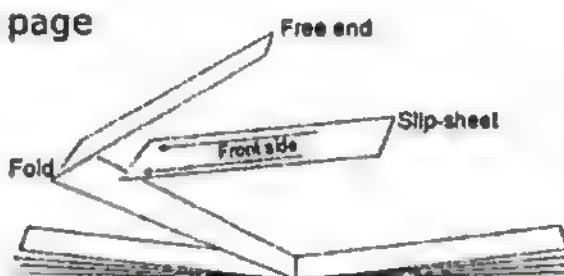


1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

1. Open the foldout page
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The Tragedy.

y



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 **INEFFICIENT**—As a banker and executive, Mr. Potter needs top-notch performance from his PC. But he made the mistake of ordering the *other* brand and that hourglass won't disappear.

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 **COSTLY**—No one, especially a banker, likes to see their money fly out the window. Mr. Potter witnessed just such an occasion when he bought his expensive PC from the *other* guys. For all that money, he didn't get applications software, local bus performance or a built-in surge suppressor. The clunker wasn't even upgradable!

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SX-25

PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$1695



486
DX-33

PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

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486
DX-33

PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2195



486
DX2-66

PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2495



486
DX2-66

PACKAGE #3 BONUS:

- 8MB RAM
- 256K SRAM system cache
- 528MB local bus IDE hard drive
- Diamond Viper local bus video card
- 15" SVGA color monitor
- Both floppies
- 14,400 bps V.32 bis send/receive fax modem
- DOS, Windows, Mouse
- Choice of Windows application

\$2995



486
DX2-66

PACKAGE #4:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2995



486
DX2-66

PACKAGE #4 PLUS:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Diamond Viper local bus video card
- Vertical case
- 15" SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

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Ambra[™]
486SX-25

PACKAGE #1:

- 4MB RAM
- 107MB hard drive with built-in 32K cache
- Both floppy drives
- SVGA color monitor
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Circle 155 on reader service card.

PCs

AST's Premmia LX P/60: Pentium Power And PCI Local Bus

BY BRUCE BROWN

AST Research's Premmia LX P/60 brings two technologies new to AST's desktop PC line: Pentium processing power and Intel's PCI local bus. The low-profile Premmia chassis has a limited number of drive bays, but for a single user who wants a very fast system at a fairly reasonable price, the system makes an attractive package.

Outfitted with an Intel 60-MHz Pentium processor, 16MB of RAM, and a 540MB hard disk, the estimated selling price of the Premmia LX P/60 is \$4,475 without a monitor.

AST didn't just stick a Pentium CPU into a 486 system motherboard upgrade socket. The Premmia has a 64-bit data

path. The standard 256K external RAM cache is also essential for good Pentium performance. On PC Magazine Labs' benchmark tests, the Premmia had an average Pentium processor score and a higher-than-average DOSmark score. DOS disk performance was a bit below the average, while video performance was very good.

Intel's PCI (Peripheral Component Interconnect) technology is used in the LX P/60 both as a local bus for on-board video and for two additional expansion slots. The integrated ATI Mach32-based Windows graphics video accelerator circuitry works in conjunction with an AT&T 24-bit TrueColor RAM-DAC and 1MB of 45-nanosecond video DRAM. Both the DOS video and Graphics Win-



LOW PROFILE: The powerful Premmia comes in a small-footprint design.

Mark scores were above average, thanks to this setup.

In addition to the two PCI slots, the Premmia has three 16-bit ISA slots for existing interface cards. Few cards that take advantage of the PCI slots are

available right now, but the wide adoption of PCI as a bus standard guarantees that many will be available soon.

The Premmia's relatively small 4.2- by 17.2- by 16.2-inch case (HWD) has two externally accessible 5.25-inch drive bays and two 3.5-inch bays, one of which is for internal devices only.

As the top of the revised Premmia line, all of whose models now have improved video circuitry, the LX P/60 isn't for everyone, but if you want a Pentium system and want to be an early PCI adopter, the LX P/60 is a fine system.

• List price: *AST Premmia LX P/60 with 16MB RAM, 256K external RAM cache, 540MB hard disk, \$4,475. AST Research Inc., 16215 Alton Pkwy., Irvine, CA 92718; 800-876-4278, 714-727-4141; fax, 714-727-9355.*

Circle 420 on reader service card

Databases

Approach 2.1: Data Access Easier than Ever

BY SAL RICCIARDI

Approach was a breath of fresh air in the Windows database market when it first came out, and Lotus's Release 2.1 continues in the tradition of earlier releases by striving to be as easy to use as possible for relatively ordinary database tasks.

Approach excels at providing easy access to information stored in a variety of database formats. You can create forms, reports, form letters, and labels with minor effort. Forms can have repeating panels, which let you easily create one-to-many forms such as the one shown here. You can custom design a form and then use the same form to specify queries. This approach, natural and easily mastered, is good for most queries.

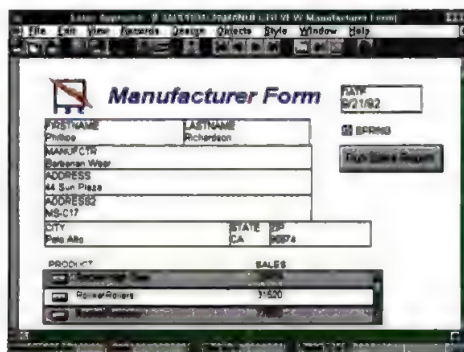
New are a number of features common to other Lotus products. For example, there are

SmartIcons—icon bar buttons that give you quick access to features. A dynamic status bar provides information about your current environment and lets you access common functions.

For example, you can quickly switch to another form via a menu that pops up from the status bar. In design mode, Approach supports the right mouse button. You right-click on an object to get object-specific pop-up menus. New features include the ability to read and write Lotus 1-2-3, Release 4, spreadsheets and to share mail-merge and drag-and-drop capabilities with Lotus's Ami Pro.

One of Approach's strong

points has always been its ability to access a number of different database types, including dBASE III Plus, dBASE IV, FoxPro, Paradox (through Version 3.5),



DATABASE EASE: Approach makes it easy to create one-to-many forms quickly.

Sybase/SQL Server, and DB2. Support now includes Oracle, Versions 6 and 7, and Microsoft's ODBC specification. Additional improvements in the new release include the ability to search

memo fields, support for .GIF and .TGA graphics file types, and batch reading of SQL records for improved performance.

Approach is not without some quirks. There's still no context-sensitive help, and field formatting is post-edit, so true edit masking isn't supported.

The interface is inconsistent, too. To resize a field object you click on it and drag one of the four object handles. To resize a repeating panel, however, you must hit Ctrl-click and then drag one of the special handles.

These quibbles aside, Approach still provides the quickest path to the basic database access, editing, and reporting tasks needed in most database applications.

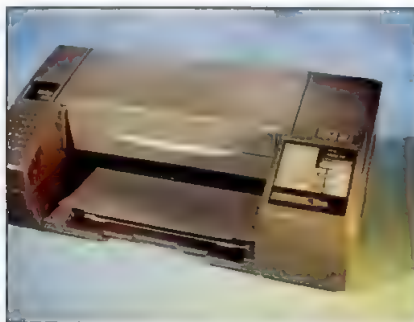
• List price: *Lotus Approach, Release 2.1, \$395. Requires: 2MB RAM, 12MB hard disk space, Microsoft Windows 3.0 or later. Lotus Development Corp., 311 Penobscot Dr., Redwood City, CA 94063; 800-386-8600, 415-306-7890; fax, 800-346-3508.*

Circle 419 on reader service card

BY MARK BROWNSTEIN

Printers

BY LANCE ULANOFF



■ Color Printers

QMS ColorScript Laser 1000: Toward A Colorful World

BY M. DAVID STONE

Not many products are literally in a class by themselves. But as the first relatively affordable color laser printer, the QMS ColorScript Laser 1000 can claim that distinction. Of course, the key word is *relatively*, with the \$12,499 list price looking like a bargain only if you compare it with the \$40,000 or so you would have had to pay for a color laser printer until now.

One of this printer's key strengths, compared with printers using most other color technologies, is that you can use it for both color and black-and-white printing at 300-dpi resolution. You can, for example, print a single color page in an otherwise black-and-white report without having to collate output from two printers.

A large part of what makes this convenience possible is print speed. QMS claims 8 pages per minute for black-and-white text. On PC Magazine Labs' text speed test, the printer managed a respectable 6.7 ppm in PCL mode, and 6.6 ppm for PostScript.

Add any color to the page—as, for example, a heading in color—and the speed drops to a claimed 2 ppm, assuming there are no graphics. A few informal tests suggested that the 2-ppm rating is about right; still much faster than most color printers. For graphics, the printer clocks in at 1 graphics page per minute.

Another important

factor that makes the printer appropriate for black-and-white printing is the price per page. QMS claims a cost of 3.9 cents per page for 5 percent coverage in black. For color printing, add 1 cent for each percent of coverage.

For PCL compatibility, the ColorScript Laser 1000 offers HPCL-5c (the color version of HP's HPCL-5) along with the same set of scalable fonts as HP's PaintJet XL 300 (including Courier, Line Printer, Times Roman, Univers, and Zapf Dingbats). For PostScript you'll find QMS's own PostScript Level 1 and Level 2 interpreters, along with 65 Type 1 fonts.

The printer can automatically switch emulations for each print job. In our tests, the switching worked flawlessly.

FOUR CARTRIDGES

Setting up the ColorScript Laser 1000 is much like setting up any other laser printer, except that you have to install four develop-

er cartridges and four toner cartridges, one for each of the four colors: cyan, yellow, magenta, and black. All the cartridges are color-coded to make sure that you put them in the right place.

The printer can accept input from all ports simultaneously. It comes with parallel, serial, and LocalTalk ports standard, with various flavors of Ethernet and Token-Ring interfaces as options. You'll also find a SCSI connector for an external hard disk. An internal 65MB hard disk holds the controller software. Also inside the box is an 25-MHz Intel 80960CF RISC processor and 12MB of RAM standard, expandable to 32MB.

The central issue for any color printer is how good the output looks. The ColorScript Laser 1000 does well enough on this score but just barely, which is a little disappointing at this price.

The good news first. The printer produces solid, fully saturated colors with much the same look as output from thermal wax transfer technology. A big advantage for the laser output, however, is that the image won't scratch or flake if you crease the page or run a sharp object over it accidentally.

The bad news is that there's no resolution enhancement, and at 300-dpi resolution, most colors show obvious dithering. The toner has a slightly shiny look,

FACT FILE

QMS ColorScript Laser 1000

QMS Inc., One Magnum Pass,
Mobile, AL 36618;
800-523-2696, 205-633-4300;
fax, 205-633-4866.

List price: \$12,499, including parallel, serial, and LocalTalk ports; Ethernet NetWare, Ethernet TCP/IP, or EtherTalk interface, \$699; Token-Ring NetWare, \$999; Token-Ring TCP/IP, or TCP/IP with DECnet, \$999; second paper tray and feeder, \$625.

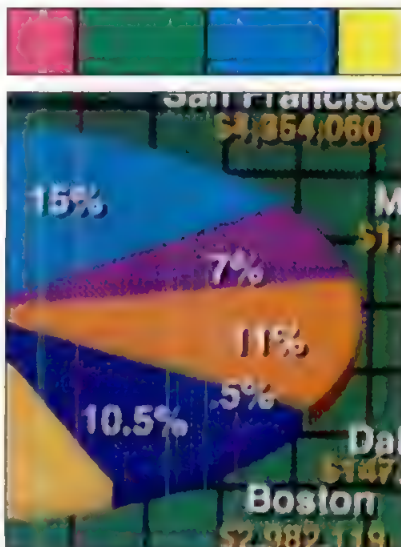
In short: The ColorScript's output quality is roughly on a par with thermal wax output, but given the much faster speeds and the much lower cost per page, the ColorScript Laser 1000 makes it practical to print both color and black-and-white on one printer.

ON READER SERVICE CARD

much like thermal wax output. (According to QMS, this is because the printer fuses more toner to the page than do monochrome laser printers.)

Characters are a little less well formed than you might probably expect from a 300-dpi laser printer. Like the Canon CX engine in the original HP LaserJet, the Hitachi engine in the ColorScript Laser 1000 is just a little ragged around the edges. Fortunately, these flaws aren't enough to ruin the overall effect of brilliant color.

The QMS printer is reminiscent of the original LaserJet in other ways, too. At roughly 21 by 22 by 15 inches (HWD) and weighing in at 106 pounds with consumables, it has the same kind of big, bulky look about it. But it also has the same quality of being good enough and inexpensive enough to spark a move toward making color laser printers mainstream, the same way the HP LaserJet sparked the move toward monochrome laser printing. □



COLOR BREAKTHROUGH: The ColorScript Laser 1000 sets a new price standard. Solid colors are nicely saturated. Without resolution enhancement, however, 300-dpi graphics show color dithering.

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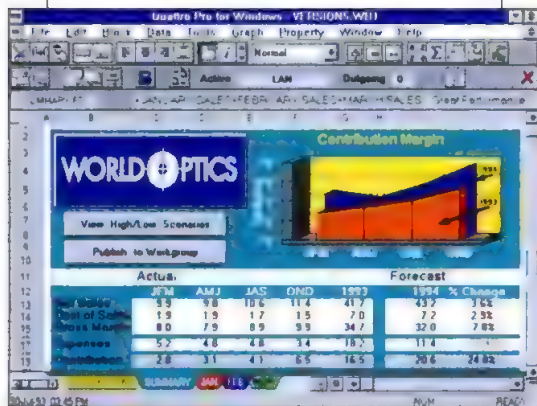
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PCs

NEC Image's Integrated Design Yields Great Performance

BY BRUCE BROWN

NEC Technologies' third iteration of its Image PC series, represented here by the top-of-the-line NEC Image 486es, displays impressive engineering that combines several high-performance features in systems that can still claim Energy Star compliance, at least when configured with a secondary RAM cache. As a look at the benchmark test results shows, the Image 486es scored significantly above the average on every DOS- and Windows-based test we ran.

While NEC's Ready line is intended for entry-level users and its PowerMate series targets mainstream users, the Image line is for no-compromise power users. Image 486es systems are available with either Intel 486DX/33 or 486DX2/66 processors. Our test system, equipped with the faster DX2/66 CPU, 8MB of RAM, a 256K external RAM cache, and a 540MB hard disk, has an estimated street price of \$2,867. With 4MB of RAM and no secondary cache, the computer sells for \$2,575. Versions with smaller hard disks or with only a floppy disk drive are also available.

The small-footprint 5.5- by 14.5- by 16.5-inch (HWD) Image

486es case has extractable feet and a rotating keyboard and mouse connector unit so you can position the case horizontally or vertically on or beside your desk. The case has two accessible 5.25-inch drive bays, one accessible 3.5-inch bay, and one internal 3.5-inch bay. The card riser connected to the motherboard has four 16-bit ISA expansion card slots, two of which held VESA VL-Bus extension cards.

OPTIMIZED DESIGN

The motherboard is the key to the performance features on the Image 486es series. All interfaces and controllers are integrated, including the local-bus video and the hard disk circuitry. The main board in the system includes impressive video, hard disk, energy-conservation, expansion, and interface components. All ROM chips on the motherboard use flash memory, giving you the ability to update to the latest ROM versions easily when they become available.

Designed for efficient airflow, the Image's motherboard components and case are intended to keep even a 66-MHz Pentium system cool enough with

the unit's single fan (though no Pentium version has been announced yet). The 237-pin ZIF OverDrive socket is paired with jumperless CPU identification so if you upgrade the system you won't have to even look for the manual.



TOP OF THE LINE: The Image 486es is NEC's most powerful 486 system.

Maximum RAM expansion is 128MB with four 32MB SIMMs. If you want a lot of memory but don't want to have to discard the initial 4MB standard SIMM, you can increase the system RAM to an even 100MB by keeping the original unit and adding three 32MB SIMMs.

NEC's video circuitry includes a Tseng Laboratories hardware graphics accelerator with 2MB of 45-nanosecond

video. No monitor is included in the system price.

SCSI, VESA VL-BUS

For fast data throughput, the Image 486es's OptiBus technology combines a VESA VL-Bus IDE controller and block-mode IDE multiple-sector reads and writes. As PC Magazine Labs' benchmark test results show, the OptiBus implementation pays off handsomely.

In case you want to install a SCSI hard disk, the Image 486es has standard internal Fast SCSI II interfaces. These ports can also be used to hook up CD-ROM drives or tape backup units. Configuring attached SCSI devices is simplified and once again jumperless, accomplished with the included EZ SCSI software utility.

In its basic configuration without an external RAM cache, the Image 486es is Energy Star-compliant, consuming 30 watts of power or less in power-down mode. If you install the external RAM cache, power consumption in power-down mode rises a bit (less than 10 watts), so the unit is no longer strictly Energy Star-compliant. Monitor power use is cut as well, though you'll only get down to 30 watts of monitor power consumption on monitors that have their own Energy Star-compliant circuitry.

PC buyers who need or want a full-out machine will appreciate the Image 486es's power and expandability. Energy Star compliance is a valuable addition, and the three-year warranty is reassuring, but this system's design priority is clearly high performance.

• List price: NEC Image 486es, with 66-MHz 486DX2 processor, 8MB RAM, 256K external RAM cache, 540MB hard disk, DOS 6.0, Microsoft Windows 3.1, EZ-SCSI, \$2,867. NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888, 508-264-8000; fax, 800-327-8329.

Circle 421 on reader service card

Benchmark Tests: NEC Image 466es

The NEC Image 466es performs much better than the average 486DX2/66-based PC thanks to its 256K external RAM cache and Optibus technology.

We used PC Magazine Labs' PC Bench 8.0 and WinBench 4.0 to test the Image 466es's performance.

	PC Bench 8.0				WinBench 4.0	
	Processor (score)	Video (score)	Disk (score)	DOSmark (score)	Graphics WinMark (millions of pixels per second)	Disk WinMark (score)
NEC Image 486es	47.8	6,995	1,327	759.3	13.4	1,140
Compaq Deskpro 486/66M	47.1	3,207	1,016	677.8	9.8	941
486DX2/66 average	39.7	3,359	1,049	592.7	9.5	861

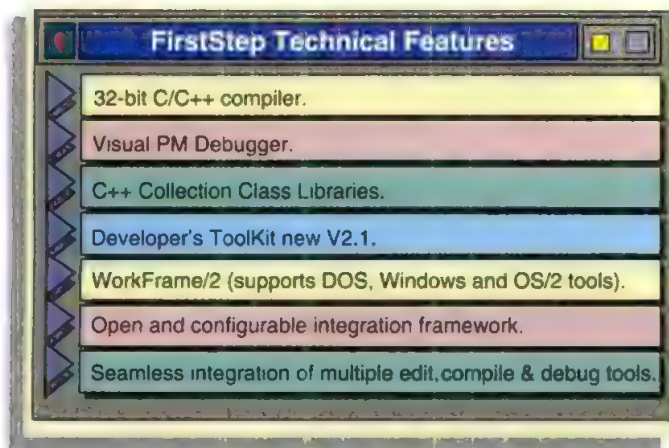
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C Set ++



Applications Development

PowerBuilder 3.0: Client/Server King

BY STEPHEN W. PLAIN

When it comes to client/server application development in Windows, PowerBuilder is king. As part of Powersoft Corp.'s new Enterprise Series—a trio of products that are geared toward scalable enterprise development—PowerBuilder, Version 3.0, now includes enough added power and versatility to keep it on the top. The \$3,595 program is available only for Windows 3.1 and will not run under Windows NT, but the company plans to release a 16-bit NT version early this year.

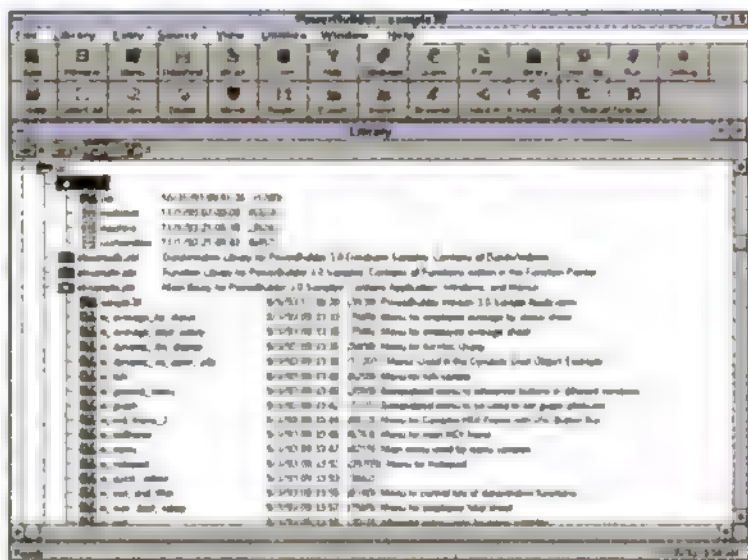
Perhaps the biggest single addition to the product is the inclusion of Watcom SQL, a 32-bit standalone SQL engine. The Watcom engine eliminates the need to connect PowerBuilder to a separate server product. Applications using the Watcom engine can be distributed royalty-free or can be easily converted during deployment to work on a different server by changing the database profile information.

ODBC has been added to the product's long list of supported servers and specifications, as well as Sybase's Net-Gateway for DB2 and IBM's DB2/2. PowerBuilder offers a much more vendor-neutral approach to database support than does Gupta's SQLWindows, its main competitor. PowerBuilder has native support for various servers, while SQLWindows requires a Gupta router product for each non-SQLBase server.

POWERFUL ENVIRONMENT

PowerBuilder's interface consists of a series of GUI "painters" to work with objects such as databases, applications, menus, and windows. This modular environment is an excellent framework for PowerBuilder's OOP (object-oriented programming) abilities. Encapsulation, inheritance, and polymorphism are all supported in PowerBuilder. At PowerBuilder's heart is a central repository of objects and attributes that can be easily shared among programmers to define the look and behavior of new objects quickly.

In PowerBuilder's powerful DataWindow painter, you graphically create database-aware windows that contain built-in functions for accessing and updating the database, as



ALL TOGETHER: PowerBuilder's Library Painter provides central access to objects.

well as interacting with the user. It's this ability that sets PowerBuilder apart from other development products not specifically geared toward database development. While one of its competitors, Microsoft's Visual Basic, offers data-aware controls, it requires considerable work to build an object as powerful as a PowerBuilder DataWindow.

The Library painter, the

screen on which you manage all of the various objects in a PowerBuilder application, helps integrate PowerBuilder with other products. PowerBuilder now supports CODE (Client/Server Open Development Environment), an architecture introduced by Powersoft to provide an open API for the integration of third-party products like CASE tools. PowerBuilder objects can be imported from and exported to text files containing all of an object's definition information.

TWO SIDES

When it comes to PowerBuilder's version control, there's good news and bad news. The bad news is that the rudimentary check-in and check-out services provided in the Library painter will fall short of many developers' requirements. The good news is that the product offers seamless integration with third-party version control products. We tested PowerBuilder with Intersolv's PVCS, the version control system recommended by Powersoft, and found the implementation smooth and unobtrusive. The company sells a package including PowerBuilder, PVCS, and the necessary link software for \$3,995.

Coding in PowerScript, PowerBuilder's BASIC-based language, is about as friendly as coding gets. Like Visual Basic, PowerScript lets you define scripts that are attached to various events, both built-in and user-defined. In the Script painter, you can use PowerBuilder's object browser to paste names of objects, controls, functions and windows, a useful feature in especially large projects. PowerScript supports embedded SQL statements, giving you constant control of the database. True to the traditional OOP style, PowerScript uses dot notation to indicate objects and attributes. New to this version is the use of the right mouse button to access object attributes and styles quickly.

Crosstab and label styles

have been added to the beefed-up report painter in PowerBuilder.

BROTHERS IN ARMS

Aside from the improvements to the product, PowerBuilder gains added value through the introduction of the two other products that make up the company's Enterprise Series: PowerMaker and PowerViewer.

The \$349 PowerMaker lets end users create customized forms, reports, and query specifications. Like PowerBuilder, PowerMaker comes with the Watcom SQL engine for stand-alone development.

PowerMaker uses a concept

FACT FILE

PowerBuilder,
Version 3.0;
PowerMaker;
PowerViewer

Powersoft Corp., 70
Blanchard Rd., Burlington,
MA; 800-937-7693, 517-229-
2200; fax, 617-229-8104.

List price: PowerBuilder 3.0, \$3,595; PowerMaker, \$349; PowerViewer, \$199.

Requires: 4MB RAM, 12MB hard disk space, Microsoft Windows 3.1.

In short: As part of Powersoft's new Enterprise Series, PowerBuilder 3.0 achieves a new level of OOP development power and performance.

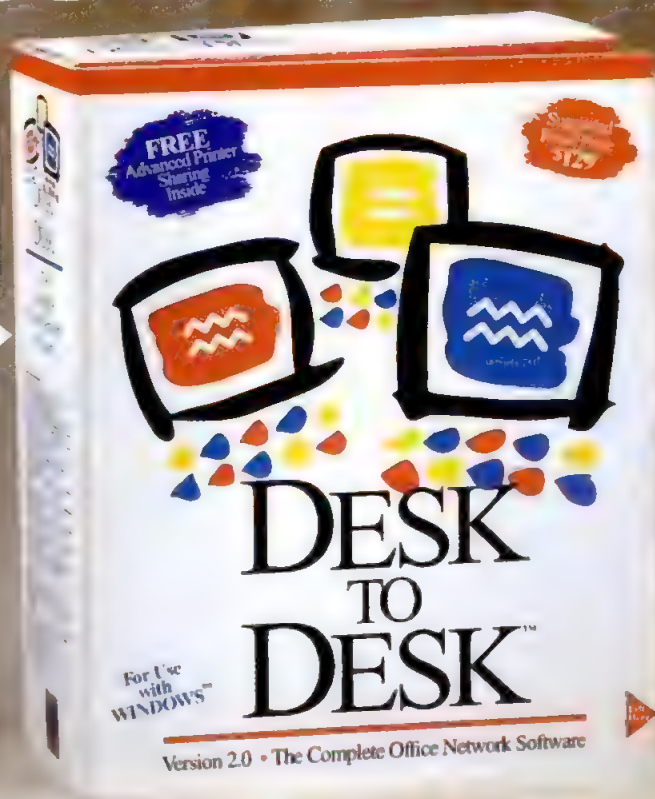
ON READER SERVICE CARD

called "form QuickStyles" that gives you the choice of various predefined form styles and guides you through the process of making them fully functional. This powerful feature simplifies the creation of complex master/detail forms, allowing users to build data-entry forms quickly.

PowerViewer is a \$199 end-user querying and reporting tool. It uses "report QuickStyles" to offer functionality similar to PowerMaker's forms element. As with all Enterprise Series products, PowerViewer provides business-level charting in a wide range of 2-D and 3-D formats. □

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Complete File Sharing	Yes	Yes	Yes
Password Security	Yes	Yes	Yes
CD-ROM Sharing	Yes	Yes	Yes

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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Brad Grimes

NEW

NEC Multimedia PC Ships with Triple-Speed CD-ROM Drives

NEC Technologies' latest entries in its Ready line of small-office/home-office PCs are multimedia systems with NEC CD-ROM drives built in. The Ready 425CD is based on a 25-MHz 486SX CPU and has a double-speed drive, while the Ready 433CD3 has a 33-MHz 486SX CPU and one of NEC's new triple-speed MultiSpin 3Xi CD-ROM drives. Each system comes with NEC's third-generation local-bus video technology, a 16-bit stereo sound card, Labtec CS-800 speakers, and a 9,600-bps fax/2,400-bps data modem. Among the bundled software are Compton's Interactive Encyclopedia and Knowledge Adventure's Dinosaur Adventure and Space Adventure. The NEC Ready 425CD2 comes with 4MB of RAM and a 170MB hard disk, while the 433CD3 comes with 4MB of RAM and a 150MB hard disk.

• List price: *NEC Ready 425CD2*, \$1,599; *NEC Ready 433CD3*, \$2,099 (monitors not included). *NEC Technologies Inc.*, 1414 Massachusetts Ave., Boxborough, MA 01719-2298; 800-388-8888, 508-264-8000; fax, 800-327-8329.

Circle 402 on reader service card

NEW

Software Artistry's Help Desk Software Goes Windows

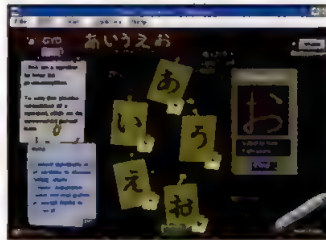
Software Artistry has debuted the first Windows version of Expert Advisor, help desk automation software that combines call tracking and problem management with diagnostic technologies like expert systems, decision trees, and case-based reasoning. Expert Advisor 1.0 for Windows is a client/server application with DDE, OLE, SQL, and multimedia support. It ships with complete application source code and uses an optional mainframe interface to integrate into an enterprise-wide problem management system.

• List price: *Expert Advisor 1.0 for Windows*, approximately \$55,000 for 10 workstations. *Software Artistry Inc.*, 3500 Depauw Blvd., #1100, Indianapolis, IN 46268; 800-795-1993, 317-876-3042; fax, 317-876-3258.

Circle 403 on reader service card

Photography by Thom O'Connor

HOT PROSPECT



Multimedia Japanese Learning Tool Improves, Ships on CD-ROM

Critics of multimedia have cited the lack of practical applications as one factor that holds the medium back. But with CD-ROM drive sales on the rise and programs like **BayWare's** *Power Japanese* for Windows 2.0 on the market, those critics have been silenced. *Power Japanese* for Windows is a multimedia learning tool that uses sound, animation, and interactive lessons to teach you how to speak, read, and write in Japanese.

Version 2.0 includes a 10,000-word dictionary for looking up Japanese-to-English or English-to-Japanese translations from anywhere in the program. There's also a text editor that lets you prepare Japanese documents by entering the English equivalents of Japanese phonetic characters (known as *kana*). Once you've prepared a document, you can print it on any Windows-compatible printer or save it as a PostScript file and import it into another Windows application.

There's also a voice record/compare feature that lets you speak into a microphone and then compare your accent to that of a native speaker of Japanese. Besides the CD-ROM, a floppy disk version of *Power Japanese* is also available.

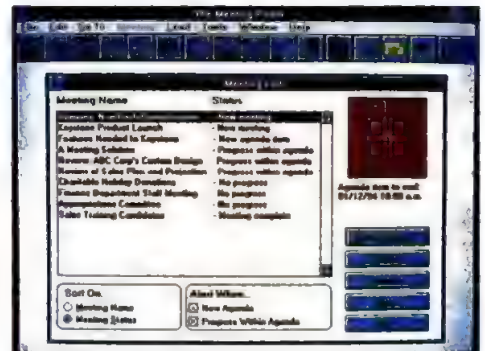
• List price: *Power Japanese for Windows, Version 2.0*, \$389. *BayWare Inc.*, 1720 S. Amphlett Blvd., #205, San Mateo, CA 94402; 800-538-8867, 415-312-0980; fax, 415-578-1884.

Circle 401 on reader service card

NEW

New Software Lets You Hold Meetings from Your PC

By running **Eden Systems'** *The Meeting Room* for DOS and Windows across your existing network, you may never have to get the staff together for a face-to-face meeting again. The Meeting Room performs all the tasks that you perform when you organize a meeting, from setting an agenda and inviting participants to recording and distributing minutes. It is the vendor's hope that when you use *The Meeting Room*



The Meeting Room means never having to gather the staff together for a meeting again.

Room you'll be more productive because you'll be comfortable to contribute ideas freely, you'll be working from your PC and have information at hand, and you'll be able to attend meetings when and from where it's best for you.

• List price: *The Meeting Room* for DOS, OS/2, or Windows, \$895 for 10 users. *Eden Systems Corp.*, 9302 N. Meridian St., #350, Indianapolis, IN 46260-1820; 800-288-9510, 317-848-9600; fax, 317-843-2271.

Circle 404 on reader service card

NEW

Leave Your Notebook Home When You Give a Presentation

You usually need a notebook PC to give a presentation with an overhead projector and an LCD projection panel. But that's not the case with **IntelliMedia Corp.'s** line of IntelliView presentation systems. You just create your slides at the office using a presentation

New & Improved

graphics program, such as Harvard Graphics or Freelance Graphics, save it to a 3.5-inch floppy disk, and then run it on the IntelliView system with an overhead projector.

Both the IntelliView DPS-I and DPS-II use active-matrix color technology in 8.4-inch and 10.4-inch panels, respectively. They each weigh about 8 pounds and contain a 486SLC processor, 4MB RAM, a 120MB hard disk, and a 3.5-inch 1.44MB floppy disk drive. They have standard serial, parallel, PS/2 mouse, and PS/2 keyboard ports, plus a port that supports an external VGA display. An optional SCSI interface and PCMCIA slot are also available. For controlling presentations, both come with an infrared remote control that was developed jointly with Mind Path technologies.

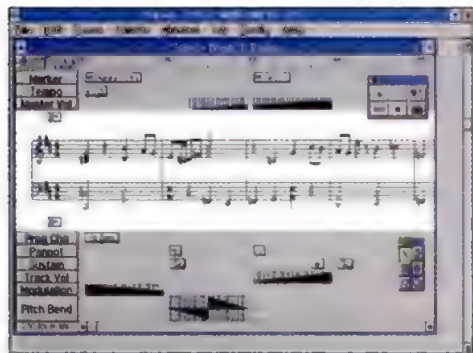
• List price: *IntelliView DPS-I*, \$5,995; *IntelliView DPS-II*, \$6,995. *IntelliMedia Corp.*, 455 Riverview Dr., Benton Harbor, MI 49022; 800-706-0077, 708-834-7141; fax, 708-834-7145.

Circle 405 on reader service card

NEW

Ballade MIDI Sequencing Software Arrives in Windows

Dynaware USA's entry-level MIDI sequencing and notation software product, *Ballade*, is finally available for the Microsoft Windows graphical environment. With *Ballade for Windows 1.03* you can perform 16-track MIDI sequencing and scoring in one of four main screens: Mixer, Piano Roll, Score Editor, or Score Preview. A Score Printing feature lets you print out tracks individually or as a complete orchestral score, with song



Ballade goes Windows: Dynaware's MIDI sequencing and scoring software makes composing easy.

and track titles, and page and measure numbers.

The new Windows version of *Ballade* also supports Creative Labs' Voice Assist software, giving you the ability to use voice commands to perform *Ballade* functions by speaking into a microphone. *Ballade for Windows* even lets

BRIEFS HARDWARE

Acer America Corp. has unveiled its Pentium-based AcerPower Series 9000 and 486-based AcerPower Series 8000T systems. The first \$3,795 Pentium PC is based on a 60-MHz processor, with EISA bus architecture and VESA local bus expansion. It comes with 16MB of RAM and 512K of second-level cache. In a \$5,195 Windows NT configuration, it also comes with a 500MB SCSI hard disk, a SCSI CD-ROM drive, and an Ethernet interface card.

The AcerPower 8000T series (starting at \$1,399) is based on a minitower design with six ISA slots and two VESA local bus slots. Bundled systems come with a 4MB of RAM, a 340MB hard disk, and a 9,600-bps fax/2,400-bps data modem. 800-368-2237, 408-432-6200

Genicom Corp. has introduced the Genicom 7610 desktop laser printer (\$1,599), a 10-ppm printer that provides output at 600 dpi with high-resolution enhancement. It's PostScript- and PCL 5E-compatible and includes emulations for the IBM Pro-Printer XL24E, Epson FX-850, Diablo 630, and HP-GL printers. It has 83 resident font styles and 10 bar codes, and it accepts PCMCIA flash memory cards and HP-compatible cartridges. Standard memory is 2MB. 800-443-6426, 703-949-1708

Look for **Toshiba America Information Systems'** new XM-4101 series of double-speed CD-ROM drives to begin popping up in multimedia systems. The \$320 internal and \$410 external drives feature a 300-kilobyte-per-second transfer rate, support Kodak multisession Photo CD, and are MPC-2-compliant. A 64K buffer comes standard on both models. The internal drive is just an inch high and consumes only 3 watts, so it is aimed squarely at the market for "green" PCs. 714-457-0777.

SoftWorx has announced a Windows version of its PC-InterLink printer-sharing and file-transfer device (\$229.95). By attaching a port adapter to the PC's parallel port, you can connect up to four systems across a miniature "network," with up to 200 feet between

you record your own .WAV files from a variety of external sources and play them back as part of your score.

• List price: *Ballade for Windows, Version 1.04*, \$99.95. *Dynaware USA Inc.*, 950 Tower Lane, #1150, Foster City, CA 94404; 415-349-5700; fax, 415-349-5879.

Circle 406 on reader service card

IMPROVED

Logitech's AudioMan External Sound System Measures Up

AudioMan 1.1—the next generation of **Logitech's** external sound system—allows you to input audio through a microphone as well as play sound through the integrated speaker. After plugging into the parallel port, *AudioMan* plays back 8- and 16-bit mono and stereo files as well as MIDI files; it also records voice or sound from other sources like tapes and CDs. *AudioMan 1.1* also comes with BeST-speech ReadOut from Berkeley Speech Technologies, a text-to-speech utility that reads aloud from user-highlighted text within most Windows programs. *AudioMan Annotator* from Voyetra lets you voice-annotate messages in any Windows program that supports Object Linking and Embedding.

• List price: *AudioMan 1.1*, \$179. *Logitech Inc.*, 6505 Kaiser Dr., Fremont, CA 94555; 800-889-0043, 510-795-8500; fax, 510-792-8901.

Circle 407 on reader service card

NEW

Look, Acrobat! No Hands!

No Hands Software has announced *Common Ground 1.0* for Windows, its challenge to Adobe Acrobat in the arena of electronic document distribution. *Common Ground* for Windows uses Zenographics' ZScript technology and Pipeline Associates' PowerPage interpreter to convert PostScript files to *Common Ground* format without a separate application.

In addition, *Common Ground for Windows* includes built-in support for the JPEG compression standard, a series of industry-standard Mastersoft filters for saving *Common Ground* documents into word processors, support for Object Linking and Embedding (OLE) 2.0, and the Panose Typeface Matching System for mapping fonts.

• List price: *Common Ground 1.0 for Windows*, \$189.95. *No Hands Software*, 1301 Shoreway Rd., #220, Belmont, CA 94002; 800-598-3821, 415-802-5800; fax, 415-593-6868.

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Don't lie to me.

X

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For more information, call 1-800-NEC-INFO. Or for details via fax, call NEC FastFacts™ at 1-800-366-0476, request document #23768. We'll answer all your questions about CD-ROM. And you'll actually get to have an honest conversation for a change.

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New & Improved

NEW

Parallel Port CD-ROM Drive Hits Double Speed

Attaching a CD-ROM drive to your parallel port rather than having to go through the pain of an expansion card installation is an attractive option, but **Micro Solutions'** first such Backpack drive suffered from a slow data transfer rate. The new Backpack Model 162550 uses double-speed technology to deliver a 300-kilo-byte-per-second transfer rate in a portable, multisession PhotoCD-compatible drive. The new Backpack uses a front-loading motorized tray rather than a caddy and has a pass-through parallel port that lets you remain attached to your printer when using the CD-ROM drive. If you need to, you can daisy-chain up to four Backpack drives on one system. For all its advances, though, the Backpack 162550 still isn't fully MPC-compliant because it requires so much of the CPU's attention during data transfer (it can't achieve 150 KBps while using 40 percent of the CPU's power).

- List price: *Backpack Model 162550*, \$499. *Micro Solutions Inc.*, 132 W. Lincoln Hwy., DeKalb, IL 60115; 800-890-7227, 815-756-3411; fax, 815-756-2928.

Circle 409 on reader service card

NEW

Brainstorming Software Makes Its Windows Debut

It's been quite a few years since **IdeaFisher** released the DOS-based version of its namesake brainstorming software program, which gained a following for its ability to spit out dozens of words and ideas related to a topic. Now the vendor is shipping IdeaFisher for Windows, with more idea associations than before (775,000) including current cultural terms and events like "channel surfing" and the Great Flood of 1993.

Two features completely new to the product are Randomizer, which uses an algorithm to mix up a list of ideas into endless combinations, and Synchronizer, which links windows so that when you scroll through ideas in one window, all other windows scroll in synch. Like a good Windows application should, IdeaFisher uses a toolbar and over 50 buttons for navigating the program.

- List price: *IdeaFisher for Windows*, \$199. *IdeaFisher Systems Inc.*, 2222 Martin St., #110, Irvine, CA 92715; 800-289-4332, 714-474-8111; fax, 714-757-2896.

Circle 411 on reader service card

BRIEFS

HARDWARE

PCs. The Windows software manages the print queuing and file transfer functions. Transfers rates can reach between 27 KBps and 33 KBps, depending on the CPU speeds of the PCs using PC-InterLink. 800-327-5013, 214-480-8278.

Microcom has introduced two 28,800-bps V. fast fax modems, the Microcom DeskPorte *FAST* and the portable Microcom TravelPorte *FAST* (\$499 each). Both modems can use the parallel port of a PC to effectively increase the throughput speed to 115,200 bps. Each has MNP 10, support for CCITT standards, and flash memory for downloading software upgrades. Each modem will also be upgradable to the new Telecommunications Standardization Bureau (formerly CCITT) standards, when the standards are ratified, for \$39. 800-822-8224, 617-551-1000

With **Applied Concepts'** new SCSI Switch (\$795 to \$895) you can switch locally or remotely between SCSI computers and peripherals. It supports fast SCSI (10 megabytes per second) devices in synchronous and asynchronous modes, allowing you to connect laser printers, page scanners, RAID arrays, tape backup systems, and CD-ROM drives and select them electronically without reconfiguring cables. Selection is controlled on a front panel or through a remote RS-232 connection. 800-624-6808, 503-685-9300.

SOFTWARE

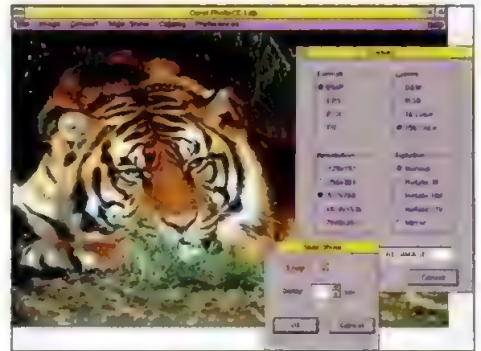
Ares Software is shipping Version 2.0 of FontMinder, its font management utility for Windows (\$79.95; upgrade for \$29.95). Version 2.0 includes enhancements to its drag-and-drop interface, a variety of type output sample pages, the ability to preview fonts before downloading, assorted portable font packs, and a PostScript font downloader. In addition, Ares has announced Font Workshop (\$249.95), a bundled package that contains FontMinder 2.0, plus FontMonger, a font conversion utility, and FontFiddler, a kerning editor. 800-783-2737, 415-578-9090

Solid Oak Software's Disk Historian (\$129.95) is a Windows utility that works

NEW

Corel's CD PowerPak May Become a Must for Multimedia

The utilities included in **Corel Corp.'s** new \$99 Corel CD PowerPak for Windows read like a grocery list of everything you need in order to take advantage of a CD-ROM drive. There's CorelSCSI device driver software, which supports almost every SCSI CD-ROM drive; Corel PhotoCD Lab, for converting Kodak PhotoCD images to .BMP, .EPS, .PCX, or TIFF formats; CD-Audio, for playing audio CDs and recording sound clips from the CD to your hard disk; and Corel Mosaic, for viewing and managing graphics files. But that's just a partial sampling.



One of the many tools in Corel's CD PowerPak is Corel PhotoCD Lab.

There's also CD caching software, a .WAV file editor, a wallpaper utility, and a set of CD-ROM extensions for sharing drives in Windows for Workgroups. You also get two CD-ROMs, one with 100 Kodak Photo CD images, the other with 150 sound clips.

- List price: *Corel CD PowerPak*, \$99. *Corel Corp.*, 1600 Carling Ave., Ottawa, Ontario, Canada K1Z 8R7; 800-836-3729, 613-761-9176; fax, 613-728-9790.

Circle 410 on reader service card

IMPROVED

Lenel Systems' Object-Oriented Multimedia Player Supports JPEG

Lenel Systems International is shipping Release 1.5 of MultiMedia Works, its object-oriented, universal multimedia player for Windows, which has support for JPEG compression and a substantially enhanced Show Builder. In the previous release, you could define background audio and graphics, but objects in a multimedia show were always played in sequence. Now you can play multiple CD, MIDI, .WAV, graphic, video, and anima-

ANNOUNCING

COREL SCSI VERSION 2

While other device drivers simply connect, CorelSCSI version 2 lets you **command!** With CorelSCSI, you can daisy chain up to seven SCSI devices to your computer, maximize the performance of your peripherals, and enjoy advanced features and applications that you won't find in any other driver software.

Ease of use, power, universal compatibility and affordability

CorelSCSI supports DOS, Windows and OS/2

Extensive CD-ROM Capabilities **new!**

- Corel's CD-ROM Writer software lets you use a recordable CD-ROM writer to create customized CD-ROMs
- Reads multi-session and Kodak Photo CD-ROM discs (XA CD-ROM drive required)
- Corel Photo CD Lab allows you to view as well as manipulate the resolution, size, color and file formats of Kodak Photo CD images

Backup Software **new!**

- Support for backups to any supported SCSI tape drive or logical device, including network drives
- Support for tape carry-over
- Intuitive easy-to-use interface for Windows 3.1

Printer Support **new!**

- Supports all SCSI Printers that adhere to the SCSI-2 command set

Advanced Diagnostic Utilities **new!**

- CorelSCSI includes several useful diagnostic utilities that let you configure SCSI device parameters, check media, display information about and thoroughly test the devices on your SCSI bus

Flexible Scanning **new!**

- Supports top-selling scanners from leading manufacturers, including direct support for the specific characteristics of each scanner
- Full compatibility for all TWAIN-compliant applications

\$129



Comprehensive Support includes CorelSCSI drivers for:

- SCSI Hard drives
- CD-ROM drives
- Multifunction drives
- Floptical drives
- Rewritable drives
- CD-ROM writers
- Printers
- PC Notebooks
- Removable drives
- WORM drives
- Scanners
- Tape drives



Ask for our free monthly Approved Products List

CorelSCSI Version 2 supports the following ASPI Host Adapters:



All logos are trademarks of their respective companies



For upgrade information or to order, call Corel

1-800-772-6735 ext.20

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tion objects at the same time. With new timing controls, you determine an object's playing duration, as well as when the next object is played. MultiMedia Works 1.5 comes on floppy disks and on CD-ROM, each for the same list price of \$99. For an additional \$99 you can get the Lenel Media Control Interface (MCI) Multimedia Drivers Kit for managing external video devices like VCRs and supporting most video boards.

- List price: *MultiMedia Works, Release 1.5*, \$99. *Lenel Systems International Inc.*, 290 Woodcliff Office Park, Fairport, NY 14450; 716-248-9720; fax, 716-248-9185.

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NEW

Pioneer Takes the Wraps Off Quadruple-Speed CD-ROM Drive

Pioneer New Media Technologies has entered a race against NEC Technologies, Texel, and others to market a quadruple-speed CD-ROM drive early in 1994.

Pioneer's DR-U104X is the vehicle for Pioneer Quadraspin technology which, combined with a 256K data buffer, offers a sustained data transfer rate of 614 kilobytes per second and a burst-mode transfer rate of 4.2 megabytes per second. The drive has a SCSI interface and supports multisession photo CDs as well as High Sierra, CD-ROM XA, and ISO 9660 CD-ROM formats. One drawback: it uses front-loading CD caddies.

- List price: *Pioneer DR-U104X*, scheduled for release Spring 1994 at under \$1,000. *Pioneer New Media Technologies Inc.*, 2265 E. 220th St., Long Beach, CA 90810; 800-444-6784, 310-952-2111; fax, 310-952-2990.

Circle 413 on reader service card

IMPROVED

WinZip 5.0 Has Zip and Unzip Features Built In

WinZip, **Nico Mak Computing's** much-lauded utility for managing ZIP files, is now in Version 5.0. Since WinZip 5.0 comes with ZIP and UNZIP functions built in, you don't necessarily need separate versions of PKZIP and PKUNZIP. Drag-and-drop functionality makes it easy to extract archived files or add new files to an existing archive. The new WinZip provides optional virus canning support and works with ARC, ARJ, and LZH files. Users of previous versions can download WinZip 5.0 from CompuServe and use their valid registration number. The upgrade costs

BRIEFS SOFTWARE

in the background to keep track of when and how many times you access files on your hard disk. With this information in hand, you can perform a variety of what-if scenarios to determine the best way to compress, delete, or migrate files in order to maximize disk space. There's also a query tool for getting information on specific files based on type or extension. 800-388-2761, 805-967-9853.

Solutionsoft is shipping Help-Breeze (\$279), a Microsoft Word for Windows add-on that lets you program hypertext presentations based on the Windows help system. It has a two-way conversion utility so that you can use the same materials for both help files and printed documentation. There's also Slide Show for WinHelp, a royalty-free dynamic link library (DLL) that lets you add slide shows, sound, and animation to help files. 408-736-1431.

Have fun with A Zillion Kajillion Rhymes, **Eccentric Software's** Windows-based rhyming dictionary (\$49.95). The search engine uses intelligent suffix and prefix stripping to find single, double, and triple rhymes. The dictionary also has syllable matching, linked hints, and a built-in text editor. The proprietary dictionary includes common, technical, literary, and slang words, as well as proper names and places. 800-436-6758, 206-628-2687.

Everyone loves fun fonts, and **MicroLogic Software** provides 96 body text fonts and 49 display fonts in its \$59.95 MoreFonts for Windows Collection. All the typefaces are hand-crafted at 1000 lines per em and are easily installed as either TrueType or PostScript Type 1 fonts. 510-652-5464.

Among cursor altering utilities, **North Shore Systems' \$49.95 CursorPower** is unique in its ability to work with both OS/2 and Windows cursors. You can magnify or change just about any type of cursor, and CursorPower also lets you enlarge the notoriously hard-to-find WordPerfect for Windows text insertion marker. 702-831-1108.

\$12 if you want it on a floppy disk.

- List price: *WinZip, Version 5.0*, \$29. *Nico Mak Computing Inc.*, P.O. Box 919, Bristol, CT 06011-0919; for credit card orders only: 800-242-4775, 713-524-6394; fax, 713-524-6398.

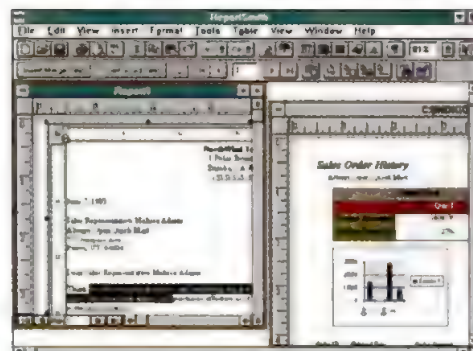
Circle 415 on reader service card

NEW & IMPROVED

Indigo Software Changes Name, Ships ReportSmith 2.0

Indigo Software has decided that ReportSmith, its flagship database reporting and query tool, had better name recognition than it itself did. So now the vendor is also known as **ReportSmith** and is shipping Version 2.0 of ReportSmith for Windows. ReportSmith 2.0 includes a drag-and-drop query interface, support for OLE 2.0, plus enhancements to its crosstab reporting and report formatting capabilities. In addition, ReportSmith 2.0 has a draft mode that lets you lay out a report with a database subset before committing it to a full report.

- List price: *ReportSmith 2.0*, \$299. *ReportSmith Inc.*, 2755 Campus Dr., #205, San Mateo, CA



ReportSmith's namesake reporting and query tool now supports OLE 2.0.

94403; 800-446-3446, 415-312-0770; fax, 415-312-9014.

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IMPROVED

Diamond Updates Viper PCI

Diamond Computer Systems has upgraded its Wietek Power 9000-based Viper PCI graphics board and lowered its price from \$549 to \$499. The Viper PCI features a high-speed RAMDAC, optimized Windows drivers, and an automated installation program.

- List price: *Diamond Viper PCI*, \$499. *Diamond Computer Systems Inc.*, 1130 E. Arques Ave., Sunnyvale, CA 94086; 408-736-2000; fax, 408-730-5750.

Circle 429 on reader service card

Move over, CorelDRAW™. Now there's a new kid on the PC block. Canvas™ for Windows. It handles complex illustrations, business graphics, presentations and page layout with equal ease. And it provides transparent file compatibility with our Macintosh® version, for the perfect cross-platform graphics solution.

IT'S TIME TO SWITCH PROGRAMS. No more bouncing between clumsy, pasted-together applications. Once you launch Canvas, you enter a seamlessly integrated graphics environment with easy-to-use pull-down menus and tear-away palettes. Draw, paint, design, create multimedia presentations, trace, edit scanned images, import and export files, and create color separations...all without leaving Canvas. Plus, our revolutionary Open Architecture lets you add new tools on the fly as you work. The same feature also makes Canvas self-upgrading, so you can add tomorrow's tools simply by dragging them to the appropriate directory. With Canvas, you'll always be ahead of the game.



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USING NOTES, YOU YOUR HEAD IN NEW Y AND STILL LEAVE YOUR H



Project Alert

Subject: Alert: Client requesting materials change

At today's client meeting, Mr. Chong announced that he has changed his mind and now wants to install the energy saving glass (E.S.G.) in all external windows. I advised him that this would have design changes and probably result in a slip in the schedule and an increase in overall cost. He is totally committed to making the change based on the future energy savings and is convinced that we can pull it off without delaying the project or exceeding the budget.

Here are some preliminary cost estimates. Let's determine a plan of action ASAP. To move forward we'll need drawings, E.C.O.'s, materials requisitions and the OK from Thierry's team in Neuilly. I've pulled the figures below from the Supplier's Catalog Database. Let's hope we can break the glass and negotiate a better price with the supplier.

Item Description	PRICE #	UNIT	QTY	AMOUNT	TOTAL
Window E.S.G.	251	Sq. Ft.	10	\$401.212	\$4,012.12
Energy Saver				\$446.163	\$446.163
Cost of Change					\$4,458.28

Following a client meeting, Ted, the Account Manager in NY, enters a Project Alert in the Project Tracking Database, describing some last-minute client changes. All key individuals on the project are automatically notified. He includes a spreadsheet comparing prices from the Notes Supplier Catalog database.

Notes

11/08/93
Alert: Client requesting materials change (see Pricebook, New York)

22/08/93
Response to Alert: Client requesting materials change
Thierry Bonnard (Neuilly) - 11/08/93 21:56

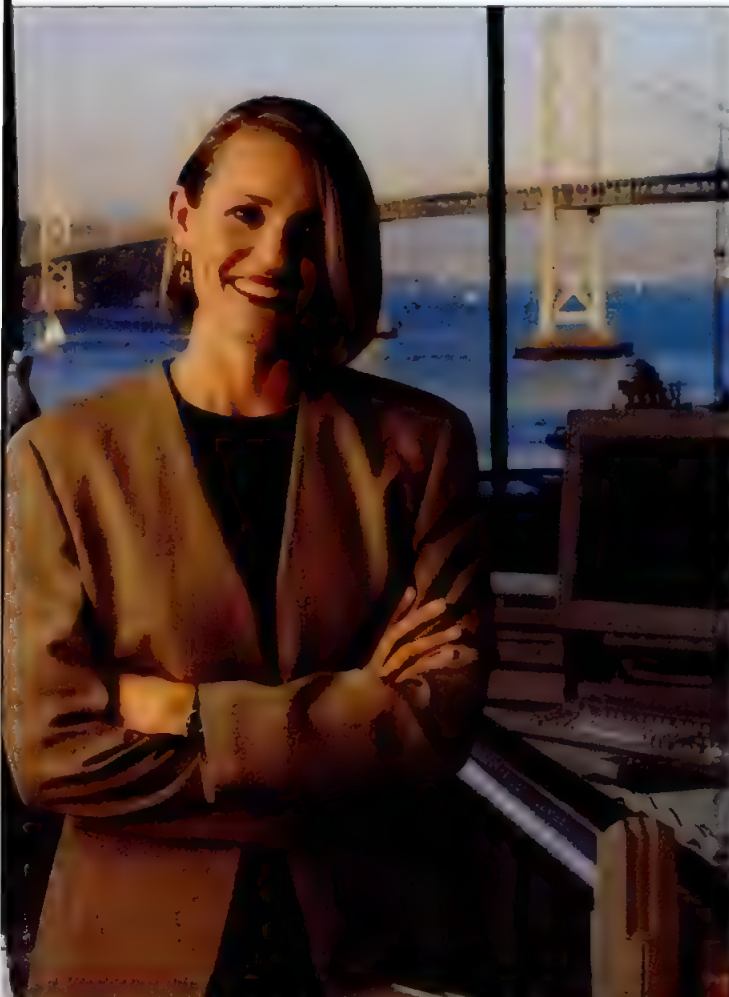
28/01/94
Re: Mon Dieu! A major change at this late date?

10/02/94
Re: You are trying to drive me mad, is not so? I cannot encourage more changes at this point. You are trying to deliver materials past 10th March will result in just labor cost of roughly \$4000. Also, we must have all glass in place by 1 Nov. before winter weather closes us down.

10/06/94
Re: If we can get the new drawings and ECO in the current construction schedule, then I think I will be able to work it into the current construction schedule and plan labor accordingly. I'll be on the lookout for the ECO and the drawings later this year, otherwise I'm afraid we must tell our client that it cannot be done. Thierry

Thierry, the construction site manager in Neuilly, is paged via Notes, and sees the Alert (as well as responses from other team members) from his Powerbook™ at the site. He responds that changes are possible only if the ECO and proper procedures are completed within 24 hours.

CAN WORK WITH WORK, AN ARM IN PARIS EART IN SAN FRANCISCO.

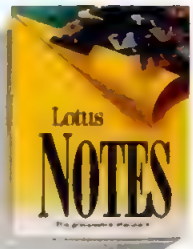


LOTUS NOTES MAKES TEAMS WORK.

Every day, more companies around the world are realizing the unique business advantages of Lotus Notes.[®] Because Notes lets teams access, track, share and organize information in ways never before possible, they can now respond more quickly and effectively to the everyday business demands of customer service, account management, product development, and more.

Let's see how Notes helped one team quickly resolve a problem caused by a last-minute client request. It involves the construction of a building in Neuilly, France, designed by an architect in the San Francisco office of a company headquartered in New York. Without Notes, this kind of responsive problem solving doesn't happen.

Notes works on all popular computing platforms including Windows,[™] Macintosh,[®] OS/2[®] and UNIX.[®] And with Notes' unique data replication feature, you can work anywhere and automatically get up-to-date information when you need it.

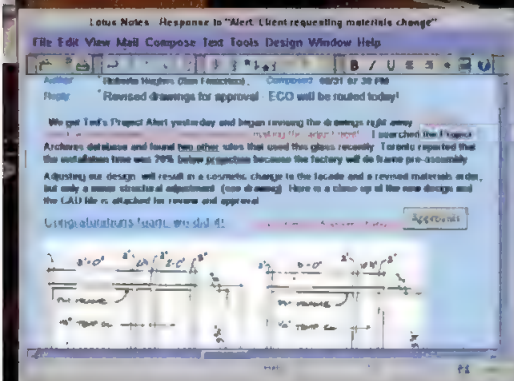


To experience the power of Notes, pick up a Starter Pack[™] for just \$995. It comes with one Lotus Notes Server for Windows and two Notes Clients for Windows. Plus 25 popular ready-to-use applications, and a "Getting Started" video that helps you get up and running quickly.

For a free demo disk, or to become a Lotus Business Partner, call **1-800-828-7086, ext. 9326** or visit your Lotus Authorized Reseller.



Roberta, the architect in San Francisco, gets to work on the drawings. But first, she checks the Project Archives database and reads about a similar job in Toronto, where money was actually saved even though material costs increased. She sends the revised drawings, including the details on the Toronto job, for the team's approval.



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PathWay Access

- ☐ Terminal Emulations:
 - ▲ VT100-340
 - ▲ TN3270, 3179G
 - ▲ Tektronix 4105/4010
- ☐ FTP Client/Server
- ☐ SMTP/POP/IMAP/NNTP
- ☐ LPR/LPD/IPR
- ☐ 4.3BSD and Windows Sockets
- ☐ NetBIOS
- ☐ NDIS/ODI/PDS/ASI
- ☐ SLIP/PPP/X.25
- ☐ MIBII SNMP Agent
- ☐ Scripting Language/Compiler
- ☐ Coexists with any NOS
- ☐ Graphical Keyboard Remapper
- ☐ NFS Client & Server
- ☐ Extensive DBMS support



PathWay Access satisfies the demanding networking requirements of DOS, Windows, Macintosh, and OS/2 users. And it does so by providing the most complete suite of TCP/IP applications available today. But power isn't enough if it's not easy to install, use, and manage. PathWay Access is. Full-featured terminal emulations, keyboard remapping and scripting capabilities are there at the click of a mouse. Printing, file transfer, and E-mail are just as easy too. When your users need the power of the network, PathWay Access is the right choice. Call us today for your free 30-day evaluation and give your users PathWay power.

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Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Lance Ulanoff

Tools to Support the Urge to Design

BY DANIEL WILL-HARRIS

The once distant relations—design and computer software—have gone from kissing cousins to near siblings. Many of the design tasks that took heavy resources—both time and money—have been, like the Fantastic Voyagers, shrunk down to size and plugged into the PC as near-boilerplate processes. So these days, the question is no longer, “Should I do it on a PC?” It’s “What else can I create on this PC?” These three new books on computer graphics and design should open your eyes to several new ideas and techniques.

The Desktop Publisher's Idea Book, by Chuck Green, has it all—great designs, complete information about re-creating them, and plenty of unexpected advice, such as where to get labels and magnets made, or how to have designs put on T-shirts.

Along with the expected sections on letterheads and newsletters, this book covers things you often use but may not have thought about designing yourself, such as mailers, coasters, place mats, flags, and more.

The majority of the book consists of projects: binders and folders, books and booklets, brochures, cards and tickets, specialty projects (bumper stickers, buttons), tags and labels, and wearable projects. Each item is introduced and photographed in use, then shown flat with rulers around the page so you don't

have to guess at measurements.

While this book couldn't be more design specific, what it isn't is software specific. So while it tells you what to use, it won't tell you how to change fonts or margins in your program.

Green's design sense for the book as well as the projects is clear and simple. His tasteful, classic, highly visual style avoids the

trendiness that quickly becomes dated. The entire book is an example of do as I say, and as I do.

Roger C. Parker's *One Minute Designer* provides a one-stop crash-course in over 200 design basics—each designed to be read in less than a minute. This concise, well-organized, and well-illustrated book covers everything you need to know about design, including page layout, display type, body copy, visuals, graphics accents, and color. A section devoted to projects dispenses specific advice and visual examples for flyers, books and documentation, brochures, business communication, newsletters, presentations, and resumes.

The strength of this book is the way it distills the information. Each item takes only one page,

■ A PC Publisher's Companion

Elizabeth W. Adler's book, *Everyone's Guide to Successful Publications* (Peachpit Press, \$28.00), is not really about computers and design, although it does feature a rather short section on desktop publishing. But it is the perfect companion to almost any computer publishing or design tome. This guide addresses the nuts and bolts areas that still must be handled outside the PC, and covers every aspect of publishing, from concept, organization, and planning to printing and distribution.—Daniel Will-Harris

with the main tip as a headline, such as “Use type size to create a visible hierarchy of importance,” a few paragraphs explaining why, and half a page devoted to showing the problems and solutions.

Art and computers used to be considered much like oil and water—they didn't mix. But now, more and more of the art that appears in magazines and even galleries has been created digitally. Gary Olsen's book, *Getting Started in Computer Graphics*, is written for those artists and designers who are already skilled at creating art with traditional media, but are ready to adopt the computer as their latest tool.

This book provides a clear introduction to computer graphics. It starts with a chapter of basics, explaining the types of graphics software, then digs deeper into hardware and software, helping new users decide

which platform to adopt, but in a pleasantly nonbiased way.

Certain pieces of important software or hardware are recommended. More often, advice is given to help readers find software and hardware that are right for them, including scanners, still video, memory, monitors, printers, mice, and digitizing tablets.

The book then focuses on software, explaining the differences between draw and paint software. While it doesn't highlight any single program, it covers the tools that are common to programs of a certain category. The book does a good job of explaining what these tools are and when to use them, and

even experienced users can learn new ways to use familiar tools. □

• **The Desktop Publisher's Idea Book**, by Chuck Green, \$21.95. Random House, 800-733-3000; ISBN: 0-533-37173-8.

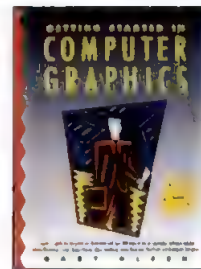
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• **One Minute Designer**, by Roger C. Parker, \$19.95. Que Corp., 800-428-5331; ISBN: 1-56529-216-2.

Circle 491 on reader service card

• **Getting Started in Computer Graphics**, by Gary Olsen, \$27.95. North Light Books, 800-289-0963; ISBN: 0-89134-468-3.

Circle 492 on reader service card



Read Only Recommends

Some food for thought for those of us confused about where technology ends and we begin. *Metaman: The Merging of Humans and Machines into a Global Superorganism*, by Gregory Stock, \$24.00, Simon and Schuster, 800-223-2348.

Dimensions (closed):
1.4" high x 11.1" wide
x 6.4" deep.

Weight: Less than
3 pounds; flash disk
model lighter.

Processor: 25-MHz
486SLC/e CPU.

Display: 640- x 480-dot
VGA; 9-inch LCD;
16-level grayscale.

**Available PCMCIA
Type II slots:**
Flash disk model: 2 slots.
Hard disk model: 1 slot.

RAM:
2 MB expandable with
optional, user-installable
RAM expansion card.

I/O: 115K-baud serial
RS-232, serial infrared
and parallel. Optional
2400-baud data; 9600-
baud send/receive fax/
modem.

**Built-in applications
and more:** In addition
to applications built into
ROM, it is also an organ-
izer. An appointment
and address book. An
alarm clock. A calendar.
A calculator. A link with
the office PC. With
options, a fax and e-mail
terminal.

Actual size ►



Now, 486 technology

The new HP OmniBook 425 PC is the best thing going for people who travel on business. Because it's the lightest full-function PC with a full-size keyboard. And it's loaded with all the features busy travelers need to take with them.

We trimmed the weight (less than 3 pounds). But not the full-size keyboard. Measuring a sleek 1.4" x 11.1" x 6.4", the



HP OmniBook 425 won't slow business travelers down. And their fingers can move across those familiar keys just as fast as on their office PC. Because the keys are the same size.



With 8 hours of battery life, travelers can keep on going.

That's continuous use of the flash disk model. And the battery pack recharges in less than 1½ hours.

Or drop in four AA batteries. Even the hard disk model lasts 4½ hours between charges.

Microsoft® applications, built into ROM. Being built into ROM makes all the difference. It means Microsoft Word, Excel and Windows 3.1 come up instantly on the 9" LCD screen. No disk space is wasted. No time lost booting.



Or going in and out of applications. Instead, hit one function key and you're in business with your next application.

Built-in mouse saves space, works anywhere. Press a button. Out comes the mouse. It's not a ball or a stick. There's nothing extra to connect. It's a genuine mouse. And it pops up to make it as easy to handle as the ones people are used to working with. Which helps make working on the road as productive as in the office.

It turns on instantly in the same place it's turned off.

Although this superportable turns completely off to save battery life, it keeps track of the last screen. And that's where it turns on again. It doesn't even have to boot up.





"The OmniBook will become the truly hip walk-around computer of choice."

— Jim Seymour,
Columnist - PC Week,
PC Magazine

"Now HP stands for hot products."

— Business Week



is really going places.

The price to lighten your workload? The HP OmniBook 425 is just \$2,125 for the hard disk model; \$2,375 for the flash disk model. The HP OmniBook 300, with a 386 chip, is \$1,600 for the hard disk model; \$1,850 for the flash disk model.

For more information call 1-800-443-1254, Dept. 753. It's going to make a lot of workloads lighter. Including yours.

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Personal Convenience. Personal Power.



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Every Nanao monitor undergoes intense scrutiny and testing to ensure maximum performance and product reliability. Our quality control processes and technical standards are among the most rigorous in the industry.

Our new line of Ecological Design™ Monitors incorporates advanced energy-saving features including PowerManager, which cuts power as much as 93% when the monitor is not in use. (After Dark screen saver software free with each monitor.)

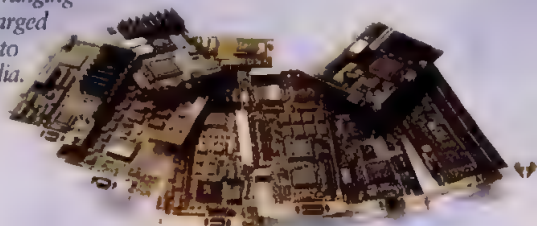


Nanao was the first monitor company to join in partnership with the EPA Energy Star Program. Our commitment to bring technical innovation to today's environment ranges from eliminating CFCs in our manufacturing process to using recyclable packaging and paper products.

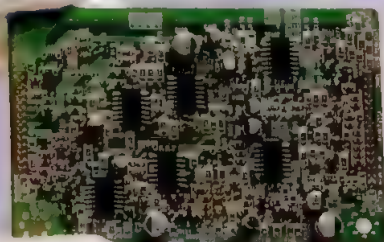
Nanao's FLEXSCAN family of monitors meets safety specifications for radiation emissions established by the Swedish MPR-II guidelines as well as those of TCO, the Swedish Confederation of Professional Employees. Nanao was the first monitor manufacturer to achieve FCC Class B approval for our 80kHz frequency monitors.



Nanao FLEXSCAN technology is compatible with all of today's popular graphics cards, offering a viewing environment ranging from enlarged graphics to multimedia.



High quality PCB boards are assembled, adjusted and inspected at Nanao's special chip-mounting factory. All PCB boards are built using sophisticated surface-mount technology.



Model	Size	Dot Pitch	Scan Frequency	Resolution
T600i	20"	0.30mm	H: 60.0kHz V: 50.0Hz	1280x1024
T560i	17"	0.25mm	H: 58.2kHz V: 50.0Hz	1280x1024
F760i-W	21"	0.31mm	H: 63.8kHz V: 50.0Hz	1280x1024
F560i-W	17"	0.26mm	H: 63.8kHz V: 50.0Hz	1280x1024
F550i-W	17"	0.28mm	H: 27.6kHz V: 50.0Hz	1024x768
F340i-W	15"	0.28mm	H: 27.6kHz V: 50.0Hz	1024x768

Nanao T-Series and F-Series monitors have captured every major award.

Every Detail.

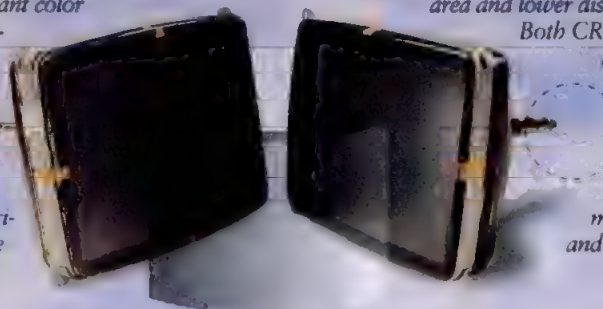
Our high resolution CRTs deliver a complete range of color displays with photographic quality and brilliant color images to sophis-

ticated applications like CAD, DTP and multimedia.

TRINITRON® CRT models offer greater precision and intricate

detail, while Nanao's Invar Shadow Mask Flat Screen CRT models provide a wide display area and lower distortion image.

Both CRTs feature our unique built-in Dynamic Beam Spot Control System that ensures maximum brightness and sharp focus.



A heritage of precision craftsmanship and attention to detail has been designed into Nanao's family of display monitors.

To reduce glare, eliminate static electricity, and improve the focus level on the display area, Nanao has developed two anti-reflective innovations: ErgoCoat,™ a protective coating for all F-series monitors, and ErgoPanel,™ a sturdy panel that covers the surface of our T-series monitors.



Our user-friendly front control panel incorporates ergonomic design and ease-of-use as well as a variety of powerful options for customizing images.

At Nanao, details make all the difference in creating our family of professional display monitors. From the product design and manufacturing that takes place in our factory to the end user's working environment, Nanao pays attention to every detail. In engineering. Assembly. Product testing. Quality control. Shipping. Customer support. From the very first days of the company, we set out to be an innovator in monitor technology. And, in a few short years, we have achieved that goal. Today, Nanao has the lowest repair rate in the monitor industry, the highest product reliability, and a fast-growing number of enthusiastic customers. So if you're looking for a superior monitor, start with the details. We do.



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Michael J. Miller

Networked PCs: Nothing Personal?

A single person running a single application on a single system may have been an accurate description of computing in the 1980s, but as we enter 1994, it's clear that the era of standalone computing is drawing to a close. Instead, the workplace now con-

sists of many people sharing data across a network of linked PCs, most of which are running multiple applications.

But do these changes mean we should let go of the "personal" in personal computing? No way. Indeed, computers must become more—not less—personal in order to handle the demands of networked computing.

WINDS OF CHANGE

Once, an office full of PCs meant a shift away from the old dumb terminals hanging off a mainframe and freedom from the constraints of a managed system. PCs gave us individual applications on our own hard disks and let us reflect our own personalities on our machines.

But today's PCs are part of networks, and that entails network management and a new kind of control. Call it what you want: downsizing, upsizing, rightsizing, or even reengineering; but by any name, it all reads the same. It's a rare business PC that's not hooked into a managed network system.

The dividing line between local area networks (LANs) and wide area networks (WANs) is also fading. PCs are hooked into LANs, and LANs, in turn, get hooked together to form WANs. PCs located at remote offices and portable machines are also subject to the network drive. Even your home PC can be hooked into the office LAN through any number of now-popular software and hardware solutions.

As the definition of PCs and networks change, the line between peer-to-peer networks and client/server computing blurs in favor of larger, distributed computing environments. Even minicomputers and mainframes are now being positioned as servers in client/server environments.

What we're left with, quite simply, are single, large networks with multiple servers and multiple clients. As the old advertisements said: The network is the computer.

THE SIGNPOST UP AHEAD

All of this has profound implications. As PCs take on more mission-critical, or line-of-business, applications, PC users face many of the same issues—reliability, backups, security, and fault tolerance—that are quite familiar to those who ran their businesses with mainframes and minicomputers.

It seems like everything old is new again. But we really don't need to, and don't want to, reenter the era of impersonal, centralized information systems and mainframes. Better we should balance the management needs and knowledge of big systems with the personal freedom and flexibility accorded by PCs. That's the challenge for 1994 and beyond.

Understanding the needs of centrally managed PCs and the types of applications they now handle may be the first step in maintaining our sense of self in an ever-growing forest of networked PCs.



*No computer stands alone anymore.
But are we losing the
"personal" in personal computing?*

NETWORK YIN AND YANG

Not every LAN or WAN is part of a centrally controlled system. In fact, we're seeing two kinds of networks. One is the "top-down" network. It's usually instigated and controlled by a centralized information-systems department and tends to be designed for one or two very large, very controlled applications. In these cases, the PCs involved do not tend to be very personal at all.

Top-down applications, such as corporate business accounting (order entry, cash receipts) and even automatic teller machines

Michael J. Miller

(ATMs), require that certain operations be carried out in the *same way at every site*. When you're figuring out how many widgets to order for each store, making sure you have the data in the right database fields is *crucial*. These are not traditional PC applications, and indeed the users of these applications don't (and shouldn't expect to) have the same kind of control over them that PC users have over personal productivity applications.

On the flip side is the "bottom-up" network. This is typically driven by a group of users or a departmental information-systems expert involved in trying to solve a particular problem, from sharing expensive peripherals to streamlining work flow, to implementing a system that will take individual data changes and perform automatic updates to a database on a file server. In these cases, the PC applications are usually much more personalized, as individuals and departments tend to know the tools that can help them the most.

Both kinds of networks regularly coexist inside one company. We've seen firms where central information-systems managers are *convinced* they have only four or five major networks, only to find that over a hundred small networks had been installed by individual departments. In these cases, central information systems tend to set up some basic standards, such as security and passwords for centralized databases, as well as basic protocols and an e-mail standard or multiple gateways.

PERSONAL CHOICES

Clearly, today's corporations and application software vendors are learning that not every computer-related task requires the same level of network management.

On the one hand, there are the mission-critical applications that must be managed and controlled widely. On the other hand, there are the productivity tools that work best when they reflect the needs of an individual or small, tightly focused group—as long as those users can import and export data through a number of common standards.

Today's applications reflect the need for software to be personalized for individual

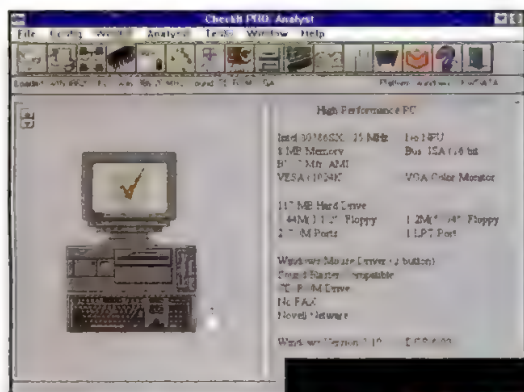
use and to connect with other applications and the larger corporate environments.

In most word processors, spreadsheet and graphics programs, and databases, you can change the appearance of menus, buttons, and so forth to make the program work the way you want. You can even customize the basic look of your system, choosing from a variety of alternative Windows desktop enhancers and replacements (that is, Dashboard and The Norton Desktop). New macro languages give you more control over your application and, in some cases, over multiple applications. Tools to filter and manage the incredible amount of information now available to most users on a network will become a more important part of computing in the future.

No personal computer in today's world is an island. Network cables span back and forth between file servers and desktops like bridges across the water. Telephone lines and even wireless connections link up remote offices and remote PCs. Networking has become part of computing in the 1990s but so is making PCs stay personal. It's why we all wanted PCs in the first place, and it's something we can't afford to lose among the wires.□

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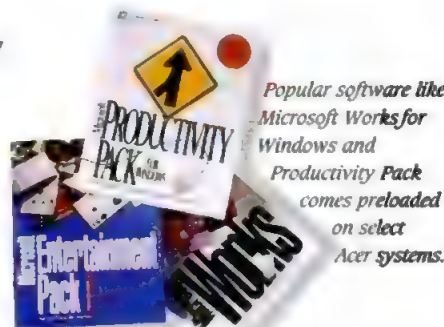


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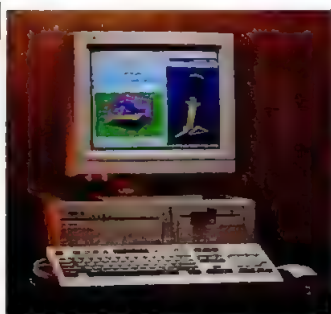


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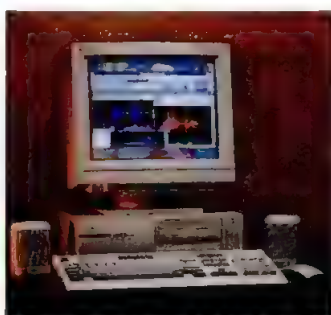


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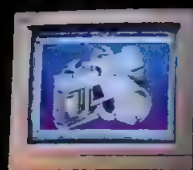
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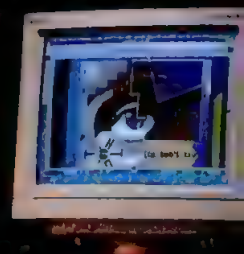


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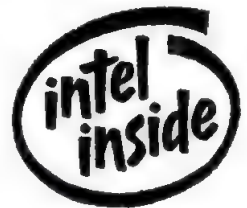
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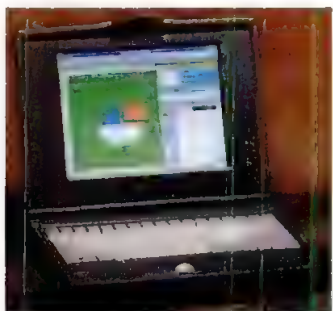


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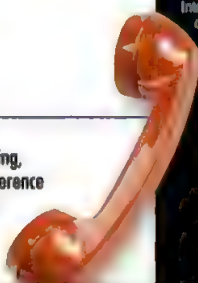


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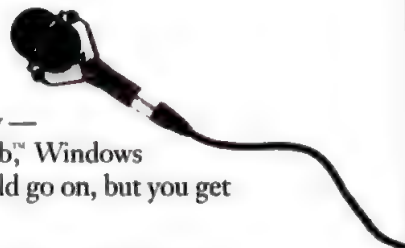
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CIRCLE 093 ON READER SERVICE CARD



Bill Machrone

In the Chips

This issue marks the tenth anniversary of my column in *PC Magazine*. So much for dwelling on the past; let's look at the future. We're so jaded by the continuing evolution of smaller-faster-cheaper that we need to take stock occasionally of the true

innovations and breakthroughs that will cause revolutionary changes in the computer industry.

The Personal Digital Assistant market is the area where we'll see the most dramatic changes in the coming year. The current crop of PDAs are interesting, but you know the line about telling who the pioneers are by the arrows in their backs. Today's PDAs are all flawed in some way, be it by poor handwriting recognition, communications support, or performance. Fixing these problems isn't trivial, and they aren't just software problems. Faster, more powerful processors are needed, and it takes an investment of many millions of dollars to put a new one in production.

The chip makers have faith in the PDA market. They're coming out with a new generation of chips that will, in the coming year, solve the current generation's problems. The new chips will pack up to ten times as much processing power as current-generation chips and use no more juice from batteries. In some cases, they'll use even less. The new chips will feature modes that range from full speed and power through power-conserving catatonia to deep coma. Virtually all the new chips will use 3.3-volt designs instead of the long-standard 5-volt design. Think of this as a lower hurdle for each electron to jump, which means that less power is required. Chips using the lower-voltage design execute processes over narrower metal lines on the chip, typically 0.6 or even 0.5 microns (millionths of an inch). Packing the transistors closer together means that designers can get more functions onto one piece of silicon.

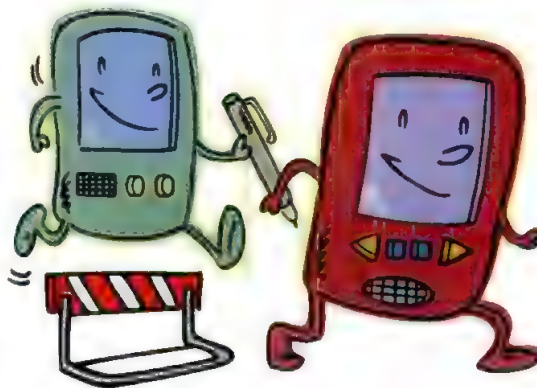
This higher level of integration yields a double benefit: It takes up less space and consumes less power than would two

chips of similar function connected by a bus. In today's world of high-speed, low-power-consumption machines, buses are the enemy. Even a bunch of copper traces that traverse no more than an inch of circuit board can be a power waster. With the microwatt power levels of today's devices, that minuscule metal pathway is like an empty pipe that needs to be filled up before any water comes out the other end. Designers call this "charging the bus," which takes time and precious power from the battery. As the next generation of chips move from 3.3- to 1.5-volt operation, look for even more single-chip integration.

The success of a PDA is determined by its human factors, and it's up to each device's electronic innards to deliver the performance that we, the users, consider acceptable. For example, the Tandy/Casio PDA (also known as the Zoomer) is a nice enough little device—if you're not in a hurry. It's crippled by an 8086-level CPU. When the developers were designing the device, they didn't have much choice within their constraints of power consumption and desired operating system. Indeed, Intel and Microsoft have been poorly represented in the PDA market; the Zoomer is the only Intel-

compatible device currently available, and Microsoft doesn't have an operating system that's suitable for PDAs.

A new chip set from VLSI Technology will catapult such PDAs from the XT level of performance all the way up to that of a 386/33. The Polar chip set will integrate the internal logic of a 386 chip with many of the other required functional parts of a personal computer. A companion chip will hold other necessary pieces, such as I/O ports and the silicon equivalent of an entire VGA board. The Polar is, in es-

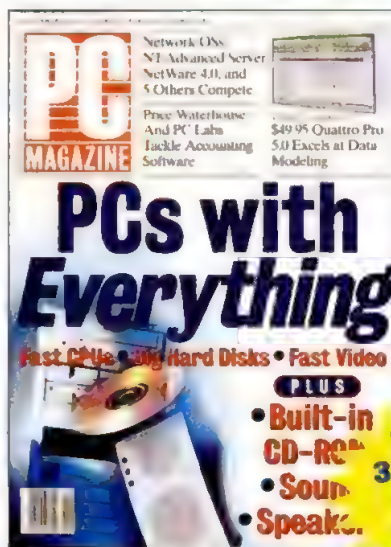


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Bill Machrone

sence, a two-chip PC that barely sips at a 3.3-volt power supply.

PDA's aren't the only market for such technology. You could easily build an entire PC into a keyboard or build even smaller, less power-hungry notebook machines. The push toward green, energy-saving PCs continues, and the differences between notebook and desktop machines are diminishing. One thing is sure, though: I'd stand in line for a Zoomer with ten times as much processing power as the current version. Performance matters, especially when it comes to handwriting recognition.

YOU'RE DENSE: A COMPLIMENT

Higher-density ROM chips are yielding benefits for today's and tomorrow's PDA's. The current generation makes use of ROMs to store all kinds of handy stuff besides the operating system. The next generation of PDA's will be portable reference libraries, with a wide variety of useful (and not-so-useful) data. You'll also be able to customize your PDA for various functions by plugging in ROM chips.

The past year has been a greening for PCMCIA, too. It's become clear that PCMCIA slots are a bad choice for adding memory or disk to a PDA or notebook, because you probably will want that increased memory or a disk all the time. So putting it into a socket makes no sense. PCMCIA slots are far better suited for communications peripherals.

Some of the most interesting products for the PCMCIA socket will be wireless. Pager modules are just now becoming widely available. They hook into your e-mail software or run in a window so that you can see your incoming messages. Look for new wireless communications technologies, such as Traveling Software/National Semiconductor's AirShare device, to fit into a PCMCIA slot in the near future. Don't expect to see an entire cellular phone in a PCMCIA slot yet. Maybe next year.

The coming year will be an interesting one indeed. The next crop of PDA's will be useful and desirable. We'll hear about Microsoft's WinPad technology, a combination of hardware and software that will put Microsoft into the race. And we'll see new and old players alike, such as ARM, AT&T, Hitachi, NEC, and Sony, back up their dreams with hundreds of millions of dollars of development money. □

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"Scoring high in overall value and design, the Micro Electronic's WinBook gives you a lot for your money, including an outstanding integral trackball."

PC MAGAZINE, Portable Computing Issue, August, 1993

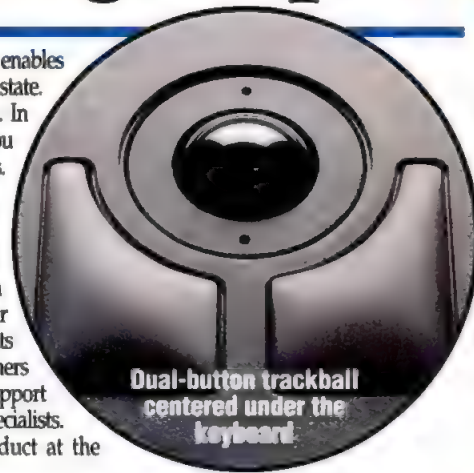
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design SL enhanced Intel486SX 25MHz chip enables the CPU to operate at a 0MHz low power state. Plus, we have fine-tuned the WinBook's screen. In monochrome and in dual-scan STN color—you get sharper, clearer images with less cursor loss.

The WinBook was engineered for Micro Electronics, a division of MEI/Micro Center, Inc. MEI is America's leading direct source for computer products. Micro Center has been selling PCs for more than 14 years—longer than IBM or Compaq—with over 736,000 units sold. With over 2.2 million satisfied customers nationwide, we have developed a superior support staff including top engineers and technical specialists. So you always get the highest quality product at the lowest possible price.



Dual-button trackball centered under the keyboard

WinBook™



WinBook 486 SX SL Enhanced Features

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Intel486 SX SL Enhanced



The 5.4 lb. WinBook, designed by award-winning Palo Alto Design

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It's 9:00, Monday morning and you've just learned the horrifying news. That big meeting with the president of the company next week? It's been moved up. Way, way up. And that report for the big meeting? It's due in half an hour. **F**ortunately, you've got PowerViewer™ for Windows™, the one tool that lets you access virtually any database and create presentation-ready reports with a few simple clicks of the mouse. **Y**ou take a long sip of coffee, sit down in front of your computer and click open PowerViewer.

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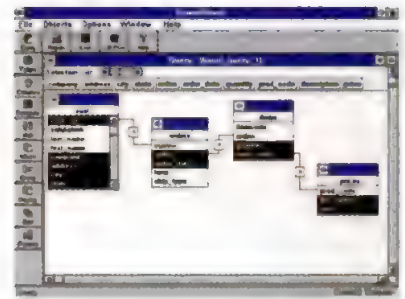
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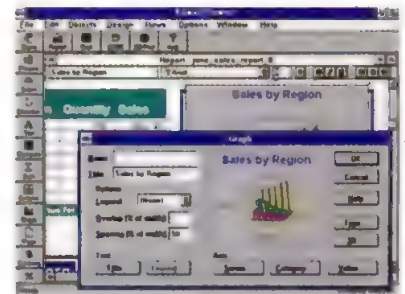
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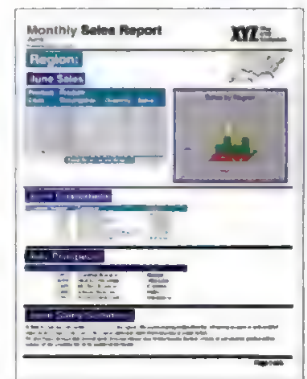
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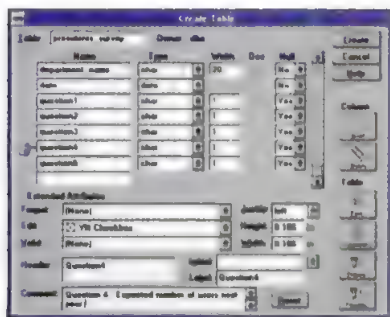


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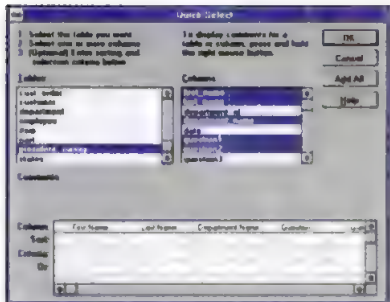


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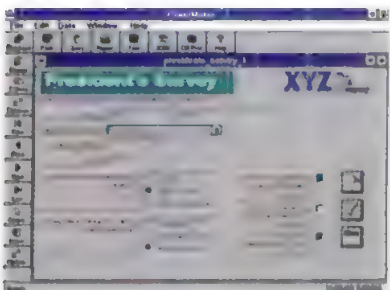
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John C. Dvorak

Seoul Man

Samsung recently invited some American journalists on a junket to South Korea for reasons that were never clear to me. Something about a new logo, I think. I usually don't attend such events because the sponsors hold me hostage and make me listen

to lectures about product shipment projections, but I had to go on this one to see what Korea is up to. And this is what I saw: The whole country is going quality crazy.

Years ago, Korea was chosen by pundits as the country that could whip Japan economically. After all, the Koreans are highly motivated to compete with Japan, which has had a history of invading Korea over the centuries. The hurt runs deep, and the Koreans have never forgiven the Japanese.

The Koreans are eager to compete, but they're not sure how to proceed. Some observers say that the Koreans may have dropped the ball on the whole technology scene. It's the Taiwanese who are getting all the attention nowadays for their manufacturing prowess. But Korea seems to be in a regrouping mode. It's changing the way it develops and manufactures products, and it's focusing on quality, not quantity.

The country is dominated by four or five major multi-billion-dollar companies that make everything under the sun—from hair blowers and rice cookers and memory chips and PCs to fork lifts and large machines that move tons of dirt. (I was especially impressed with the Samsung refrigerators and washing machines.) The new cars from leading makers such as Hyundai and Daewoo are stunners. The Hyundai Grandeur is an impressive Lexus clone, for example. A killer.

Korea has managed this progress because of trade restrictions that keep Koreans buying Korean. Those restrictions, however, are scheduled to end soon. While we complain about Japan's closed economy, Korea slaps a 100 percent tariff on imported cars. The international business community has excused this trade restriction, thinking it

best that Korea build up its manufacturing infrastructure—which it has done mightily.

At Samsung, I managed to corner the quality control chief and ask him about the perception that Korean products are of lower quality than Japanese and Taiwanese products. Korea is working on correcting that image, he said. Samsung has received ISO 9000 approval for all its plants and procedures. (ISO 9000 is a European standard used to assure the quality of suppliers.) In fact, the company has received ISO 9002 ratings (which means even the product design process follows quality guidelines) for many of its facilities. Two things pushed the company to improve the quality of its facilities and products. First, when Samsung got a contract with IBM to make the Eduquest machines, IBM sent its quality control people over to modernize the PC fabrication plant. Second, things changed fast after the CEO of Samsung was informed on a trip to the U.S. that his products were not being stocked because their quality wasn't up to par.

Korea bears watching. I recommend a visit to Seoul to see what an amazing country Korea has become. The Koreans need to beat their drum a little louder. As this is

written, they're hosting a World's Fair called Taejeon Expo '93 that has had ten million visitors and almost no coverage from the Western media. Koreans blame their own government for the lack of pro-Korean publicity. I suppose the junket might have been part of a scheme to change all that.

If Korea makes good on its new effort to improve product quality, then it will become a world force to reckon with. It would be a mistake to think that the Koreans no longer have what it takes to whip Japan. They are better poised than ever before to get it done.



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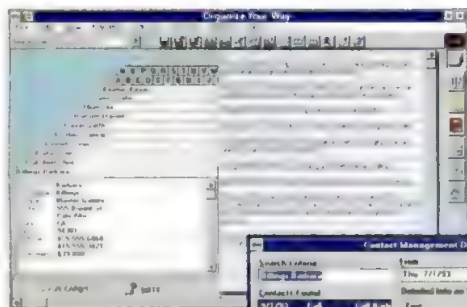
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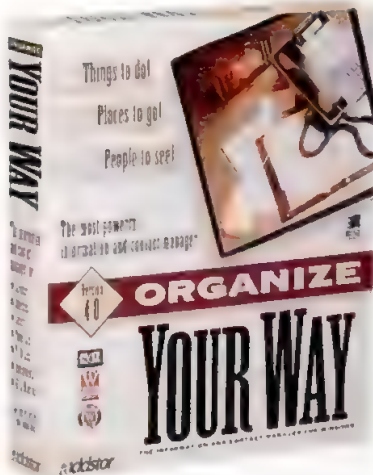
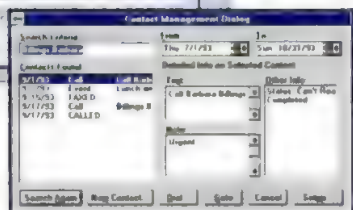
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Inside Track

W

hy Haven't They Done This Already? Dept.: I should ask, "Why don't they do this right?" Intel is putting serial numbers on its processors so it can identify stolen chips. This is an effort to thwart

the epidemic of **violent chip thefts** that **plague** Silicon Valley. Exactly what will keep the thieves from erasing the numbers and reprinting **bogus** numbers on the chips remains a puzzle. What Intel—and every other microprocessor company—should do is incorporate a serial number within the silicon itself. It should be something that can be accessed by the processor and checked. This would have the added advantage of minimizing **software piracy** by associating the software with the one CPU. There would be a number of interesting developments if this were done. For one, it would end casual software piracy.

Everyone Is Trying to Get Into the Act Dept.: Now it seems that Toshiba and AT&T have been working together to develop a **new RISC chip**. The R4600 chip, to be released soon, is supposedly faster than a Pentium, is based on the Toshiba Hobbit RISC chip, and is somehow a version of the MIPS RISC chip. (I'm *sooo* confused!) Look for it in April. This is all part of a strategy to develop new chips specifically for the next generation of hand-held computers (think EO).

Overseas Watch: Many of you have heard of Virgin Records and Virgin Airlines. Now there is **Virgin Euromagnetics**—a clone manufacturer. And, yes, it is a Richard Branson-owned company. The Virgin line of systems is led by an energy-efficient 486/66 model built solely in Europe (yeah, sure) and designed to compete with the Dell machines sold in England. The machine's gotten **rave reviews** overseas. Exactly why an airline and record company is getting into the computer business is something of a mystery to me. I suspect they anticipate that the machine will *fly* off the shelves in *record* numbers. (How could I resist?) Oh, and get this, they give frequent flyer miles with each purchase!

IBM Takes the Hint: People have wondered what IBM would do after the OS licensing agreement between IBM and Microsoft ended. The future changes in Windows, it was said, would not be easily incorporated into OS/2. So IBM did the **smart thing**: it dumped the **Windows code** from OS/2. Apparently, the newest version of OS/2 will not include Windows but will use internal hooks to capture the Windows code off of your

Watch for a new wave of chips developed for hand-held computers.

Toshiba and AT&T are working on the R4600, a chip that is reportedly faster than a Pentium.

Look for this chip in April of 1994.

system. This saves IBM a bundle in royalties to Microsoft (It's rumored that IBM pays Microsoft a \$22 royalty fee for each copy) and solves the future compatibility problem. The Windows user gets the added benefits of an improved DOS, superior file handling, true multitasking, and OS/2's crash protection. End of blatant plug.

Dvorak Predicts: Microsoft will counter this marketing ploy by installing code in Windows to **trash OS/2** in some odd way. Microsoft will excuse this with the explanation that it can't be responsible for supporting Windows if it's running under an **alien** operating system. Of course, these **code bombs** will quickly be patched out by IBM, but they will be a short-term nuisance.

Look for the minilogo "An IBM Company" to appear more and more in the future. I keep seeing logos of **odd companies** with that moniker just underneath the company name. Skill Dynamics is the most recent example. This mainframe/mini training company is about to be merged with a smaller PC-oriented training company called Catapult, which was recently acquired by IBM—a move by IBM that **amused** me, because Catapult authored the "Step by Step" series of Windows books for Microsoft Press! Anyway, at a recent training and support conference held by Ziff Institute, I was **stunned** by the sheer number of training companies. I watched a film where some woman was lecturing on what tab stops are, what they do, how they work, how to change them, and so on. I thought this to be the dumbest thing I've seen in a long while. When I brought this to the attention of a trainer, I was told that I'm naive about people's **lack of skills**. But what skill does it take to use a tab?! If you're involved in training or support, you should get on the Ziff Institute mailing list. Call 617-252-5187.

And while I'm **plugging stuff for the company**, I must tell you about the **cool** new CD-ROM version of *PC Magazine* with all the news and reviews of the past year. It uses as much multimedia **muscle** as could be mustered. The disk is \$14.95. If enough people buy the disk, it will be an ongoing product. I'm doing my part! Call 800-787-9677 to order a copy.

More Internet Humor Dept.: Posted on the net recently, this joke will appeal to anyone who has played with a Newton or any other pen-based machine that utilizes handwriting recognition. Seen outside someone's office:

Q: How many Newtons does it take to screw in a light bulb?

A: Foux! There to eat lemons, axe gravy soup.□

It all started
when you asked them
to share an HP LaserJet



printer.

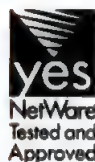


HP's JetDirect card solves the problems of shared printing.

Shared printing has been a great way to make the most of your resources. Unfortunately, it also made printing a hassle. Until now.

With HP's JetPrint utility, printing status is delivered to each user's PC.

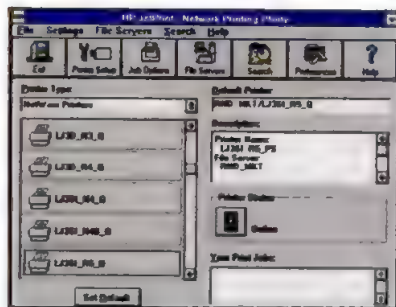
This powerful Windows-based utility for Novell Netware networks, included with HP's JetDirect card, provides users easy access to printer information. Users no longer have to jog over to the printer to check on job status. Just a simple click of the mouse and they can find out everything they need to know:



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No more hassles for them. No more complaints for you.

And no more network performance degradation or PC parallel-port bottlenecks. Print data zips along. Even graphics move along at breakneck speed. Network printer performance is maximized. It just doesn't get any better. Or faster.



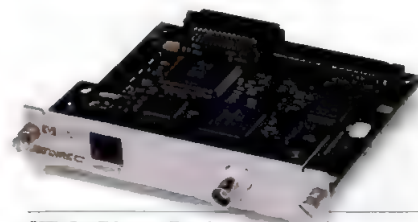
HP's JetDirect card makes your printer easy to manage.

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JetDirect EX Interface -
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and any printer with a parallel port

Network Topologies:

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Token Ring (4/16 Mbps) • Apple LocalTalk*

Network Operating Systems:

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IBM LAN Server • HP-UX, SunOS, Solaris,
SCO UNIX® IBM AIX™ • Apple EtherTalk •
Apple LocalTalk*

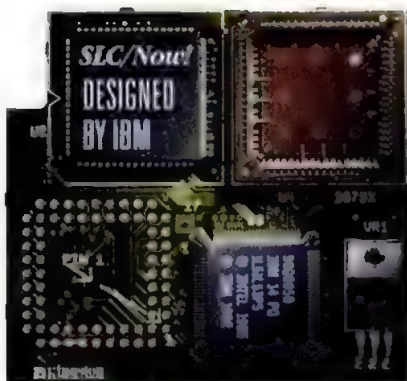
Supports industry-standard SNMP-based network management software.

*Automatic network/protocol switching is supported with the HP JetDirect card (when installed into an HP LaserJet 4Si or 4Si MX printer) and JetDirect EX interface.

*Apple LocalTalk supported by HP JetDirect card only.
**Not supported with Token Ring topology.



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Recount:	5:44 Min.	1:51 Min.	1:54 Min.	
Retail Price:		\$215	\$1,545	
SLC/Now!	PS/2 Model 50	With SLC/Now! 50	PS/2 Model 90-0109	SLC/Now!
Landmark Speed 2.0:	13 MHz	114 MHz	84 MHz	IBM PS/2 Models 50, 90Z and 60
Recount:	3:34 Min.	:29 Sec.	:38 Sec.	
Retail Price:		\$425	\$3,280	
486/Now!	PS/2 Model 70020414	With 486/Now! SX 25	PS/2 Model 90-0109	486/Now!
Landmark Speed 2.0:	39 MHz	84 MHz	84 MHz	IBM PS/2 Models 70 and 80, Compaq Deskpro Models 385/16, 385/20, 385/20e, 386/25, 386/25e, 386/33
Recount:	:55 Sec.	:39 Sec.	:38 Sec.	
Retail Price:		\$495	\$3,280	
MCMaster	PS/2 Model 5000	With MCMASTER SX 25	PS/2 Model 90-0109	MCMASTER
Landmark Speed 2.0:	16 MHz	84 MHz	84 MHz	IBM PS/2 Models 55, 56, 57, 65, 70, 80 and 90
Recount:	2:47 Min.	:36 Sec.	:38 Sec.	
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All systems tested with 16MB installed except MCMASTER tested with 4MB on-board and 4MB on mother board. All system prices are MSRP at standard configuration as of 4/1/93. Processor upgrade prices are MSRP as of 4/1/93. Recount conducted on VMD Excel for Windows spreadsheet generated by Kingston Technology.



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CIRCLE 108 ON READER SERVICE CARD



Jim Seymour

Changing the Rules of the Game

It's no news that PCs have changed businesses in important ways. Most often computers have changed how people spend their days, the skills they need, the leverage they can bring to their work. That's productivity enhancement, and it's an important part

of the benefits that PCs bring to society.

But in other areas, the low cost and wide availability of PCs, their ease of use, and the phenomenal power they bring to the individual have changed the very structure of businesses: the way the business itself is conducted.

A good example of that sort of change is what's happening now in sales of stock photographs.

I wrote here several months ago about my dismay with CD-ROMs full of stock photos that buyers really couldn't use ("The Multimedia Copyright Swamp," February 23, 1993). You had to negotiate usage rights separately for the photos on the disk; the disk was reduced to little more than an expensive catalog.

That column drew a number of interesting letters, many of them from photographers both eager to use CD-ROMs to distribute their photos and apprehensive about the potential of CD-ROMs "to utterly destroy my stock-photo income," as one wrote.

Editorial photographers have long sold only one-time usage rights to their photos, even when those pictures were taken on assignment—say, for *Life* magazine. Over time they build a valuable file of images, with great potential for sale again and again as "stock" photos. As editorial and advertising budgets have tightened lately, art directors have turned increasingly to these stock photos, buying one-time rights to reuse the photos rather than assigning new work.

Thus these sales have become important to photographers for whom stock once provided only a small trickle of income. Many photographers can tell you about pictures that they've sold hundreds of times, bringing in tens of thousands of dollars. The advent of photos on CD-ROMs is obviously a great opportunity for photographers—and a great peril.

If they allow their images to be digitized onto Kodak Photo CDs, they can put those photos in the hands of potential buyers very inexpensively. If, as is increasingly the case, those photo buyers can take the high-quality digitized images directly to the printed page, everyone gains: Photographers don't have to deal with film dupes, and buyers don't have to buy expensive, time-consuming scans.

WILL THEY PAY?

But what about buyers' willingness to pay for the rights to use each of those images, each time they use them? Are buyers interested only in disk catalogs, or do they prefer disks with images they can use without further payment?

Clearly, some disk publishers think there's a big market for CD-ROMs of images that buyers can use without further payment. Corel Systems Corp., for example, has released a library that contains more than 100 photo CD-ROMs.

What can you do with the images on these disks? The clip photo business is subdividing into three categories: disks with a few hundred images of up to about 1MB each, which are suitable for digital uses from screen

savers to multimedia productions; disks with far fewer images, each up to 20- to 40MB, suitable for high-quality reproduction on the printed page; and catalog-only disks, which are useful only for reference.

Usage rights follow that logic: You can use the first group of images in electronic-media productions; you can use the hi-res print-quality images in editorial and advertising work; and you can't use the catalog-only disks' images at all, except for "comps" to show clients how a finished piece might look.

Many of those who



The stock photo business provides a snapshot of the changes brought on by the digital age.

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CIRCLE 008 ON READER SERVICE CARD

There are two ways to quiet a noisy computer.

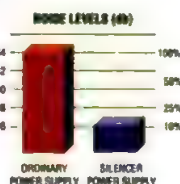


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"Power supplies you can barely hear" *PC World*, July 1993

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CIRCLE 080 ON READER SERVICE CARD

Jim Seymour

wrote to me asked what I thought of that. I told them I think it's fine, and the more I ponder the future of digital imaging, the more I'm persuaded that these are appropriate and ethical practices.

I have a foot in each camp here. Some readers know that I was once a magazine photographer (thanks for the letters; I'm flattered that you remember the name and, sometimes, the pictures). I once had a substantial file of stock photos with my agent, and earned good money from them. So I understand photographers' fear that a business being redefined will undercut their livelihood.

INSTANT ACCESS

But I now live in the digital world of computers, and work with clients who increasingly rely on access to digital images. These companies aren't interested in stealing anyone's work: They pay for what they use. But they love the idea of being able to acquire libraries of clip photos which, just like clip art, can be used and reused at their discretion, once the up-front price of the CD-ROMs in that image library has been paid.

Anyone who's pulled together a printed piece using stock photos knows how difficult it can be to negotiate terms for the correct usage rights for images, on a short timeline—and on a short budget. Anyone who's assembled a multimedia production that uses stock photos knows the agony of trying to clear the rights to all those images—and often, trying to explain to photographers and their agents just why fees for multimedia uses can't be on the same level as those for glossy four-color ads.

Curse the darkness if you will, but PCs and the digital age in general have turned a lot of businesses upside down, in the process dislodging long-established customs and practices—and sometimes eliminating jobs and incomes once thought secure forever.

I tell this tale not only because many of you will use digital images and will want to know what you're buying, but also because your own business may face upheavals like those now shaking photography. Better to think now about how you can exploit those changes, than to succumb to them.

Or, as Alvin Toffler has said, better to surf the third wave than to be swept under by it.□



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As anyone who's ever been in the desert can tell you, things aren't always as they appear. Whether it's an oasis in the sand. Or a suite of application software in the office. Unless you look very closely, for example, you'd swear Microsoft® Office was a revolutionary new

award-winning, most usable applications. All of which truly complete the desktop of every Windows™ user. And while Microsoft claims Office is going to fully maximize cross-product integration and consistency, Lotus is already way down the road to achieving

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1-2-3® RELEASE 4 AMI PRO® 3.01 FREELANCE GRAPHICS® 2.01 APPROACH® 2.1 ORGANIZER™ 2.1	EXCEL 5.0 WHEN AVAILABLE WORD 6.0 POWERPOINT® 4.0 WHEN AVAILABLE ACCESS™ COUPON FOR 1 SEAT OF MICROSOFT MAIL
INTEGRATION	
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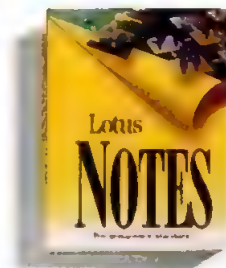
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through integrated software. When, in reality, Lotus® SmartSuite® achieved that distinction over a year ago.

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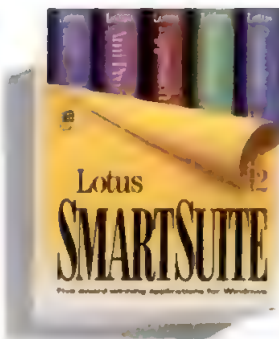
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PC Magazine, Sept. 14, '93

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CADalyst, July '93

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PC Week Magazine, June 14, '93

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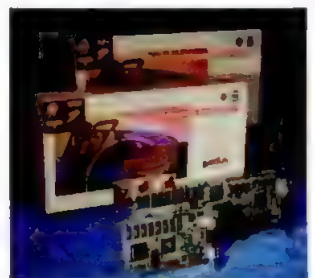
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CIRCLE 124 ON READER SERVICE CARD



Bill Howard

Ten Predictions for 1994

What will the New Year bring? More interesting products? Certainly. But what you won't see will be just as intriguing as what you will. Products we desperately want won't get real until 1995—maybe even 1996. Too many technologies are over-

hyped and underdeveloped. Here are my top ten predictions for 1994.

IBM kills the PS/2 Micro Channel. The PCI bus mated with ISA will be the polite way IBM can offer an advanced bus and back out of this seven-year-old dead end. Actually, MCA PS/2s will still be available in catalogs in case somebody really wants them for servers. Or if you want to see one, you can always take your kids to The Computer Museum in Boston. The PS/2 will be between the Osborne I and the Coleco Adam.

Docking stations still don't take off. At \$999, they sold poorly because they cost too much. Now you can get so much built into your notebook PC—300-plus megabyte hard drives, accelerated local bus video, fast LAN connections via PCMCIA—that there's less reason to have one, even though most cost less than \$500.

Token-Ring fades. You hear the word "legacy" and "Token-Ring" in the same sentence a lot these days. Sixteen-Mbs Token-Ring may be a bit better technically than 10-Mbs Ethernet, but not enough to justify the ridiculously higher cost for adapters and MAUs (hubs).

Integrated LAN adapters catch on . . . in 1995. Ethernet on the motherboard or as a tiny plug-in module makes lots of sense and allows for ever-smaller PCs. But it's a tough sell when big-name vendors like 3Com and Intel sell \$99 ISA cards. Also, IS managers want a single network card standard (and, thus, just one driver) if at all possible.

Two-way radio frequency (RF) wireless laptop technology stumbles. Sending anything but short messages kills the battery. The PCMCIA slot isn't big enough for today's electronics. Sending data over cellular phones only works in the movies. And just wait till you get the monthly

bills! That's enough to kill you. Give it a year or two.

PCs (personal communicators), yes; PDAs (personal digital assistants), no. They can't read your handwriting and they're too small to contain useful keyboards, but they all can translate block hand-printing, and receive and send messages. One device could and, eventually, will contain a pager, cellular phone, wire-line modem (to receive e-mail), and fax.

Next stop for CD-ROM drives: 2.5-inches. We want something that holds 500-plus megabytes and fits inside a notebook. The 3.5-inch CDs don't save you enough space to make them appealing. I'd bet on a version of the Sony audio MiniDisc if it held more than 140MB.

Windows NT catches on for the desktop . . . in '95 (maybe '96). Where's the software today? Where are the drivers? What are the odds you can get your IS people to install a second or third 16MB bank of RAM? (You'll need it.) For the next year or two, the 32-bit desktop Windows you really want is Chicago, meaning Windows 4.0. Now let's hope Chicago ships in 1994.

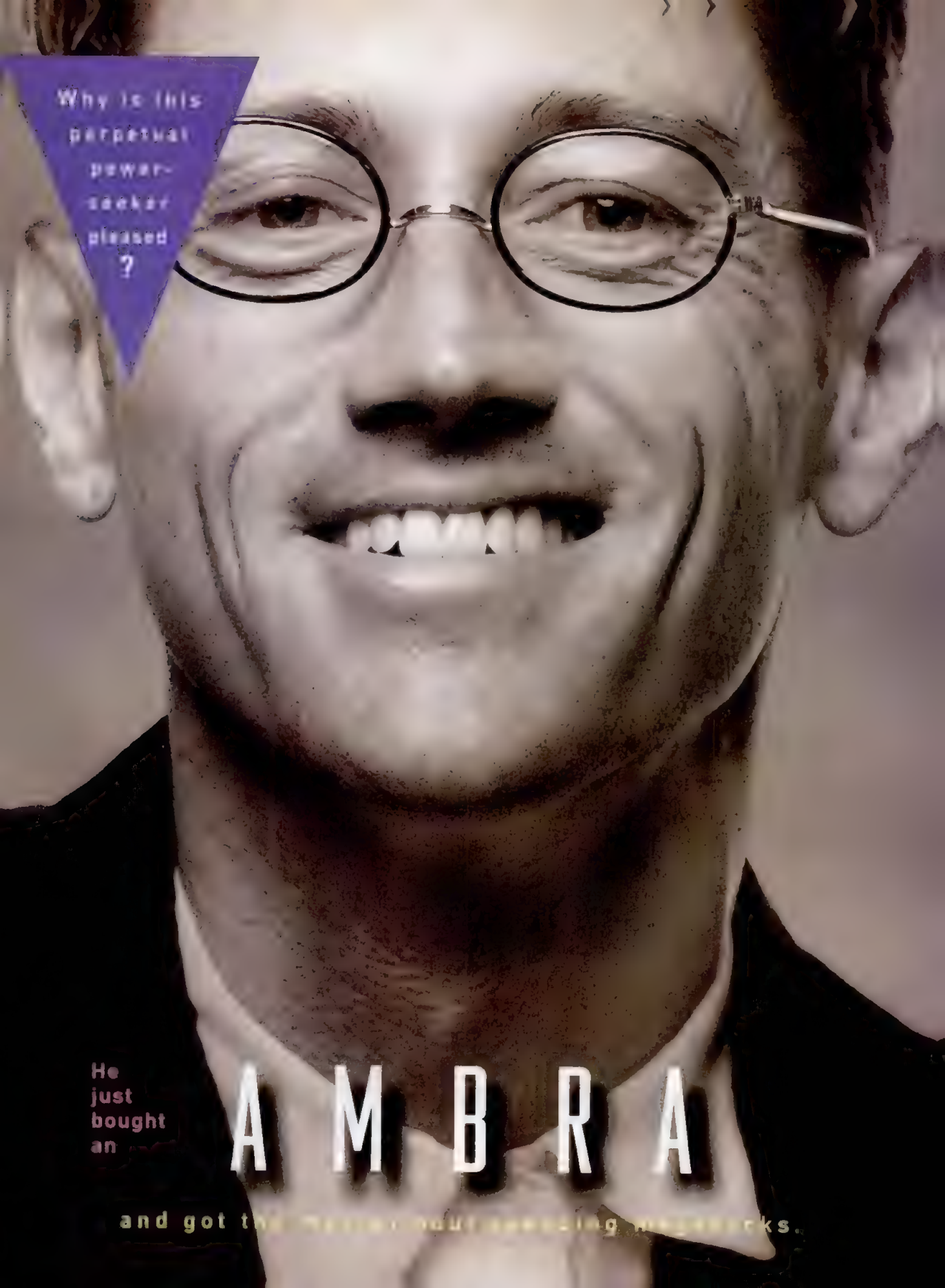
x86 architecture reigns. Trying to run existing DOS and Windows 3.1 apps on RISC PCs will be painfully slow—just as bad as doing it on a Mac—and unless there's

a flood of software written or recompiled for RISC systems real soon, your more-MIPs-for-fewer-dollars investment will be all dressed up with nowhere to go, unless you convert to Unix. Too bad; Intel chips get better (and cheaper) a lot sooner when somebody's chasing them.

OS/2 simultaneously succeeds and fails. Without a critical mass of commercial OS/2-specific software it doesn't matter that it's finally become palatable. As one Intel official puts it, OS/2's problem isn't technical anymore. It's political: OS/2 doesn't feel like a winner. □



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PCI carries a payload of
32 bits wide and 33 MHz fast,

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Networks

Multimedia

Disk drives

VESA local bus

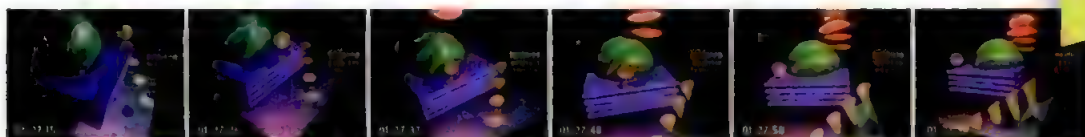
Prefer VESA over PCI? AMBRA's selection of Pentium technology systems includes towers and desktops to suit.

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**81
MILLION
WINMARKS**



1 - 8 - 0 - 0 - 2 - 3 - 9 - 5 - 7 - 2 - 9

HARD DISKS:

1GB (8.9 ms) SCSI-2
540MB (10.5 ms) SCSI-2
440MB (12 ms)
340MB (12 ms)
240MB (15 ms)
170MB (17 ms)

MULTIMEDIA:

2X CD-ROM drive
Multimedia kit
(2X CD-ROM drive,
sound card,
2 speakers)

MONITORS:

14" AMBRA SVGA
14" AMBRA UVGA
15" AMBRA Flat
Square Tube
15" NEC
Multisync® 4FGE
17" AMBRA Flat
Square Tube
17" NEC
Multisync 5FG
21" NEC
Multisync 6FG

MODEMS:

9.6 kbps Internal
14.4 kbps Internal

PRINTERS:

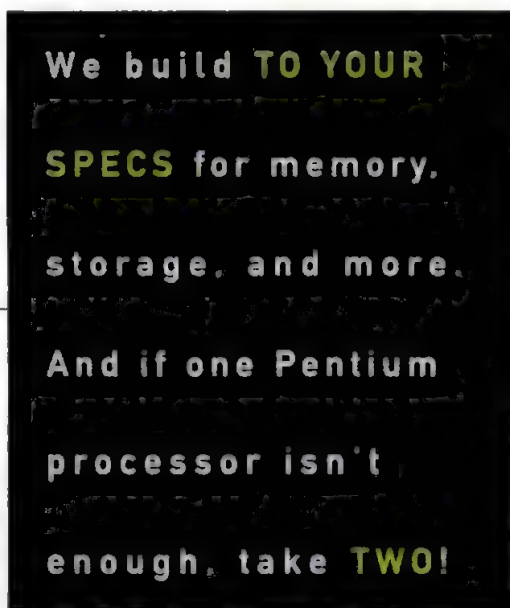
IBM 2391 Personal
Printer II
IBM 4039
LaserPrinters
IBM 4029
LaserPrinters

SCANNER:

Calera WS Complete
PC Scanner

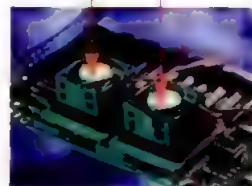
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COMPLEX IS
AVAILABLE IN
EISA TOWERS
THAT OFFER
8 SLOTS AND
12 DAYS TO
BUILD UPON.

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+ VESA
+ 1GB hard disk**

Fully configured systems starting at
\$4,351



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Intel Pentium
processor-
based
systems
from
AMBRA.



1 Model DP60/PCI

- Pentium processor, 60 MHz
- 64-bit data path
- 8MB RAM, max: 128MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 340MB (12ms) hard disk
- 4 ISA, 2 PCI, 1 PCI/ISA slot
- 6 storage bays
- PCI graphics accelerator, 2MB DRAM
- 14" SVGA color monitor, LR
- Desktop casing
- 200-watt power supply
- MS-DOS® 6.0, Windows 3.1, mouse

\$2,799

**2 Model DP60/PCI
to the max, with:**

- 440MB (12ms) hard disk
- Diamond Viper PCI, 2MB VRAM
- 2X CD-ROM drive
- 15" Flat Square color monitor, LR, NI

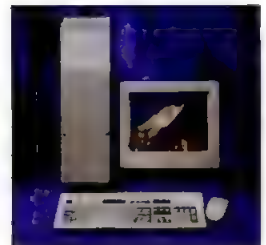
\$3,499



3 Model DP60E/VL

- Pentium processor, 60 MHz
- 64-bit processor complex
- 8MB RAM, max: 64MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 540MB (10.5ms) Fast SCSI-2 hard disk
- Onboard dual-channel Fast SCSI-2
- 8 EISA slots (2 VESA)
- 6 storage bays
- L45 ATI® Mach 32, 2MB VRAM
- 15" Flat Square color monitor, LR, NI
- Desktop casing (convertible to minitower)
- 200-watt power supply
- MS-DOS® 6.0, Windows 3.1, mouse

\$3,999



4 Model TP60E/VL³

- Pentium processor, 60 MHz; upgradeable to dual processors
- Dual 64-bit processor complex
- 8MB RAM, max: 128MB
- 512KB processor cache
- 3.5" 1.44MB diskette drive
- 540MB (10.5ms) Fast SCSI-2 hard disk
- Onboard dual-channel Fast SCSI-2
- 8 EISA slots (2 VESA)
- 12 storage bays
- L25 S3 805 graphics accelerator, 1MB DRAM
- 2X CD-ROM drive
- 15" Flat Square color monitor, LR, NI
- Tower casing
- 350-watt power supply
- MS-DOS® 6.0, Windows 3.1, mouse

\$4,719



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AMBRA covers every computer with a 30-day money-back guarantee and a one-year limited warranty. An optional IBM® one-year onsite warranty is also available to you.² With either warranty, you can rely on toll-free technical support 24 hours a day, 7 days a week.

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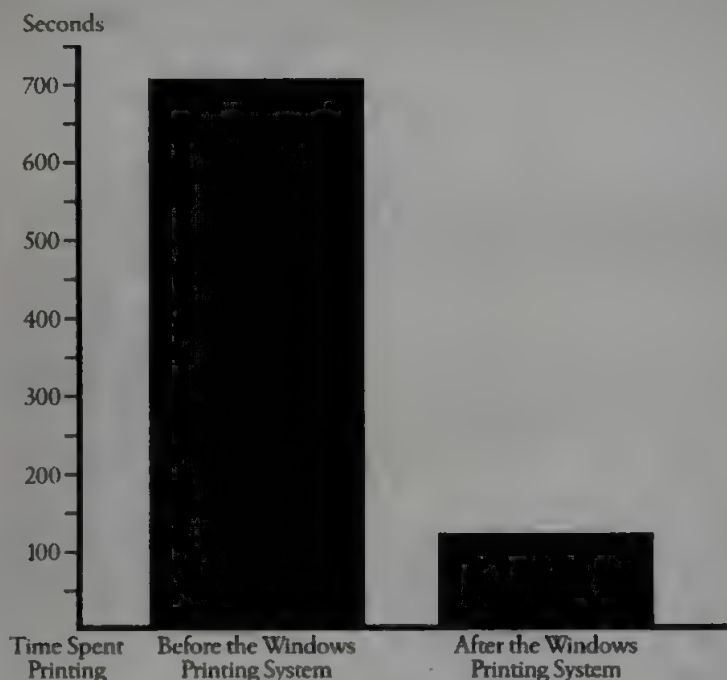


In Canada,⁴ call 1-800-363-0066, Ext. 5729

1 1,024 x 768 x 256 colors at a 72 Hz refresh rate. 2 Please call for details regarding AMBRA's money-back guarantee and limited warranty, and IBM onsite warranty. Return shipping and insurance charges are the responsibility of the customer. Onsite service may not be available in certain locations. 3 FCC Class A system, for use in a commercial environment only. 4 Offerings may differ in Canada.

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LASERJETS OPERATE ON TWO SPEEDS. BEFORE AND AFTER.



Combined print time for a 10-page Word for Windows and a 10-page Freelance Graphics document as reported by *PC Computing*, February 1993.

LaserJets[®] used to operate at one speed. Slow. But that was before the Microsoft[®] Windows[™] Printing System. Optimized to print with the Windows Operating System, it enables a LaserJet[®] to print up to five times faster.

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fonts, for greater flexibility in designing your documents. It features true WYSIWYG,

so the only surprises you'll get from the printer will be pleasant ones.

It also provides a status screen, to apprise you of things like the printer running out of paper.

Even before your first page prints, the Windows Printing System will impress you with its fast and simple installation.

So visit your nearest reseller, or for more information, call (800) 426-9400, Dept. KX7. After all, you have to work at a hectic pace. Why shouldn't your LaserJet do the same?

Microsoft

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THE BEST OF

1993

Every time we create this list, *by Joel Dreyfuss* we know that we offend someone. The products we've chosen as the best of 1993 are picked arbitrarily, subjectively, without regard for market share, editorial consensus, or technical excellence. These are products that we "like"; the ones we are likely to be using ourselves, or would recommend to our friends. The fact is, we remain computer enthusiasts and we still get giddy about things that are nifty, well-thought-out, or just plain excellent. As we plow through thousands of hardware and software hopefuls each year, we see many that are just fine and do what the companies promise. Others are hard to use, next to useless, or works in progress. But occasionally, we come across something that makes us say "Aha!" These products represent the sum of our most enthusiastic and personal approbations for 1993. Products that were winners or nominees in last issue's Awards for Technical Excellence were not eligible.

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Claris Corp.

ClarisWorks for Windows

BY DON WILLMOTT

We heard a lot in 1993 about "Office"-style application suites: integrated software packages that seamlessly interact to create document-centric workspaces. The best interface we've seen belongs to Claris's ClarisWorks for Windows, Version 1.0.

This \$249 blend of word processing, database, spreadsheet, and graphics tools (there is no communications module) is easy and intuitive to use. Start typing and ClarisWorks puts you in word processing mode, while opening a spreadsheet grid or graphics frame within the document requires just a click on the toolbar. ClarisWorks offers enough layout flexibility to let you use it as a basic desktop publisher.

As this hot corner of the software market gets even hotter in 1994, here's hoping that ClarisWorks doesn't get trampled by the big boys.

Claris Corp., 5201 Patrick Henry Dr., Box 58198, Santa Clara, CA 95052; 408-727-8227. Reviewed: June 29, 1993, page 37.

Circle 459 on reader service card

Compaq Computer Corp.

Compaq ProSignia 5/60

Gateway 2000

Gateway 2000 4DX2-66V

BY THOMAS MACE

Stick a 60-MHz Pentium chip and a 256K write-back cache onto an advanced 128-bit system board, plug in 16MB of RAM, hook up a half-gigabyte hard disk running off a Fast SCSI-2 controller, and you've got quite a server. That's the Compaq ProSignia 5/60, the

sort of hardware we would all love to have at the core of our networks. The ProSignia's TriFlex bus design with a 128-bit memory bus, 64-bit processor bus, and a 32-bit EISA bus for I/O devices makes most PC servers look quaint. The system is highly expandable and a broad range of storage options allow for multi-gigabyte configurations. Fully configured systems start in the mid-\$6,000 range.

For daily desktop work, it's hard to beat the value of the Gateway 2000 4DX2-66V (\$2,995). With a 66-MHz 486DX2 processor, 16MB of standard RAM, a 424MB hard disk, a 2MB ATI Ultra XLR graphics card, a good 15-inch display, and two VESA local-bus slots, it's amazing how much computer your money can buy these days.

Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269; 800-345-1518. Reviewed: September 28, 1993, page 40.

Circle 460 on reader service card

Gateway 2000, 610 Gateway Dr., North Sioux City, SD 57049; 800-846-2000. Reviewed: January 26, 1993, page 193.

Circle 461 on reader service card

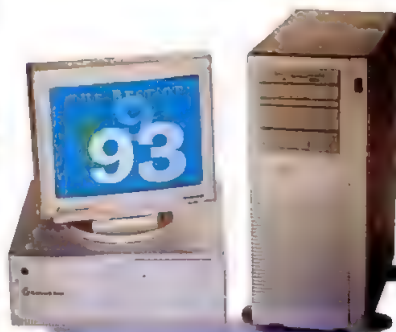
Arabesque Software Inc.

ECCO Professional

BY JIM SEYMOUR

Picking the right PIM (personal information manager) isn't easy. Aside from the usual requirements of ease of use, stability, and compatibility, PIMs demand a match between styles: yours and theirs.

Version 1.1 of ECCO Professional (\$395) may fill the needs and fit the styles of more PC users than any other we've yet seen. At its heart, ECCO is a sophisticated outliner. Literally everything in an ECCO file



Gateway 4DX2-66V and Compaq ProSignia.

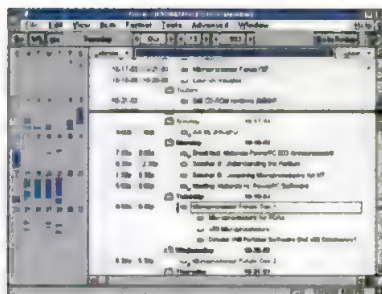


ClarisWorks: The penthouse suite.

is part of a master outline that you can expand for more detail or compress to headings only. Click on items in that outline or on boxes on ECCO's menu bar and you jump to two other ways of viewing that information: an elaborate Rolodex-style contacts file, or an appointments-and-reminders file, with daily, weekly and monthly views. As you would expect, ECCO lets you link data among these files so that you can click your way through the displays, chasing down related information. A cute cursor-like "shooter" allows easy export of ECCO information. If PIMs have disappointed you in the past, give ECCO Professional a look.

Arabesque Software Inc., 2340 130th Ave. NE, Bellevue, WA 98005; 800-457-4243. Version 1.0 reviewed: September 14, 1993, page 50.

Circle 462 on reader service card



Getting organized with
ECCO Professional.

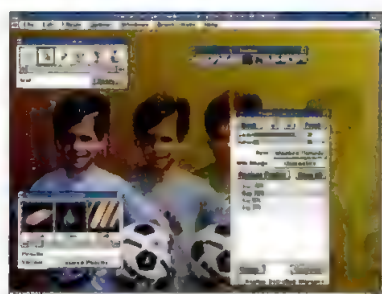
.....
Fluke Corp.

Fluke 672 Ethernet LANMeter Fluke 675 Combo LANMeter

BY FRANK J. DERFLER, JR.

Network cable problems can really fool you: A bad cable often acts like a faulty network card or even a software glitch. Two impressive new hand-held diagnostic units from Fluke excel at sorting out these muddles: the Fluke 672 Ethernet LANMeter (\$5,995) for Ethernet networks and the Fluke 675 Combo LANMeter (\$8,995) for Ethernet and Token-Ring setups. These units pinpoint software, interface card, and cable problems exactly, and though their prices may seem high, the problems they solve could have cost you far more.

On a basic level, they locate physical cable problems so you can quickly find offending connectors, patch cords, or crossed pairs in various types of twisted-pair and coaxial-cable systems. The LANMeters



PC painting with
fractals.



Easy troubleshooting
with Fluke LANMeters.

Our Contributors: *PC Magazine editors:* FRANK J. DERFLER, JR., JOEL DREYFUSS, GAYLE C. EHRENMAN, LEON ERLANGER, JONATHAN HILL, JEFF MACE, THOMAS MACE, MICHAEL NEUBARTH, ROBIN RASKIN, DON WILLMOTT, MICHAEL ZULICH. *PC Magazine contributing editors:* SHERYL CANTER, EDWARD MENDELSON, ALFRED POOR, JOHN R. QUAIN, SAL RICCIARDI, JOE SALEMI, JIM SEYMOUR, BARRY SIMON, LUISA SIMONE.

also test Token-Ring interface cards and monitor the actions of the wiring hubs. On the most sophisticated level, they monitor network traffic, present detailed error reports, and even decode some NetWare and TCP/IP packets. For broad troubleshooting capabilities, these versatile LANMeters are tops.

Fluke Corp., P.O. Box 9090, Everett, WA 98206; 800-443-5853. Fluke 650 LAN Cable Meter reviewed: July 1993, page 335.

Circle 463 on reader service card

.....
Fractal Design Corp.

Fractal Design Painter For Windows

BY LUISA SIMONE

The original version of Fractal Design Painter made a splash by simulating the brush strokes and nuances of various media, including oil paints, watercolors,

airbrushes, and colored pencils. The fractal algorithms behind Painter's deceptively simple interface produce the serendipitous effects—the bleed of colors or the texture of charcoal—that are the hallmark of real artwork.

Version 2.0 of Fractal Design Painter for Windows (\$399) adds more image-editing functions, such as special-effects filters, precision frisket

(or masking) tools, and complete lighting control for dramatic effects.

The recent release of PainterX2, a \$149 add-on to Painter 2.0, supplies powerful object-level composition functions. By keeping individual images active as floating selections, PainterX2 lets you retouch, rearrange, and even relayer the elements within a painting. And while these new features make Painter a more appropriate tool for professional illustrators, it's still a program for anyone who ever loved finger painting.

Fractal Design Corp., 335 Spreckels Dr., Aptos, CA 95001; 800-297-2665. Reviewed: May 11, 1993, page 37.

Circle 464 on reader service card

.....
Hewlett-Packard Co.

HP LaserJets 4L, 4P, And 4Si

BY ALFRED POOR

Hewlett-Packard continued raising the bar this past year, adding three models to its standard-setting HP LaserJet 4 line that collectively take command of the high and low ends of the market.

An ideal choice for network installations, the 17-

WINDOWS UTILITIES

The Top Five Windows Add-ons

Contributing editor Barry Simon runs through our favorite Windows enhancers.

With Microsoft Windows, it's often the little utilities that make life easier—so much easier that we polled our editors

a printer driver, it is accessible from any Windows application and supports graphics, Microsoft TrueType, and

and run Windows apps from its command line. Windowed EDOS sessions sport a toolbar and even drag-and-drop capabilities. (Firefly Software, 800-248-0809; \$69.95.)

WindowMagic, Version 2.0, is a Program Manager enhancement. You can assign



Dashboard's better File Manager for their top five favorites so we could pass the good word along.

Almanac, Version 3.1, is simply the most elegant clock and calendar available for Windows. You can set it to appear as a small strip with the date and time, or double-click for a full-fledged calendar where you can highlight holidays, birthdays, and other must-remember dates. (Impact Software, 909-590-8522; \$49.95 for shareware only, \$79.95 with manual.)

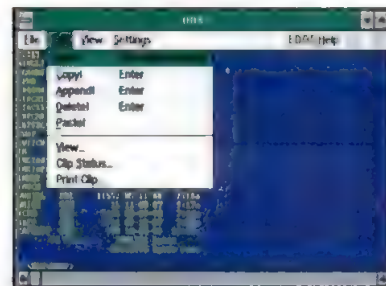
ClickBook, Version 1.01, takes output from any Windows app and prints it in one of several tiny booklet formats. You can turn your PIM into a wallet-size address book or spreadsheets into flip books. Implemented as

ATM. (BookMaker Corp., 415-617-1101; \$69.95.)

Dashboard 2.0 for Windows, is a Program Manager replacement extraordinaire. It keeps a low profile but packs a lot of wallop, with quick access to launch groups, multiple virtual desktops, quick printer switching, plus a clock and calendar. One of its best features is a DOS command-line window. Type "DIR" and you can drag a file off the listing and drop it into your Windows app. (Hewlett-Packard Co., 800-554-1305; \$99.)

EDOS, Version 3.70f, an impressive "DOS box" utility, replaces Windows' DOS sessions with its own enhanced version. You can set the size of DOS sessions above the 640K limit

icons to closed subgroups by just dragging and dropping from icon collections the product keeps. Right-clicking on a closed group produces a quick-launch list of programs in the group.



EDOS: Enhanced DOS in Windows The program also makes button bars out of groups. (WinWear, 206-882-1530; \$49.95.)

page-per-minute HP LaserJet 4Si (\$3,749) has 600-dot-per-inch output with Resolution Enhancement Technology (RET) for near-typeset quality, two paper trays that hold a ream apiece, and HP PCL 5 support with a plentiful collection of scalable fonts. Network connections are made via modular expansion cards. For those who use personal lasers, the 4-ppm, 300-dpi HP LaserJet 4L (\$849) is simple and affordable. With its one-button control panel, power-saving sleep mode, toner-stingy draft print mode, and RET to smooth the jaggies, it's the perfect companion for budget-minded users. In between falls the \$1,229 HP LaserJet 4P—a networkable, 4-ppm, 600-dpi printer with RET. All three models can be upgraded to Adobe PostScript Level 2 or purchased with it as a factory-installed option.

Hewlett-Packard Co., 19310 Pruneridge Ave.,



HP LaserJets: still in command.

Cupertino, CA 95014; 800-752-0900. Reviewed: November 23, 1993, pages 170 and 212.

Circle 465 on reader service card

Inset Systems Inc.

HiJaak PRO

BY ROBIN RASKIN

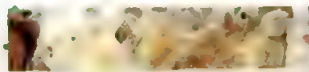
The HiJaak name has long been synonymous with graphics conversion, and HiJaak PRO, Version 2.0 (\$169), fills in what once were gaps in this versatile product. Version 2.0 is a one-stop solution for Microsoft Windows and DOS image capture, simple image processing, image management, and conversion between more than 70 file formats. Common image processing functions such as color reduction, brightness adjustment, cropping, and sizing are simple to use. Version 2.0 adds laudable speed improvements, a simple image browser, a clip-art library, and some appreciated usability enhancements. For example, you don't need to know what type of file



CONGRATULATIONS BILL
YOU'RE DORK OF THE MONTH.



DORK BALL!!!



OH MY GOD,
YOUR DAD'S A DORK
TOO!



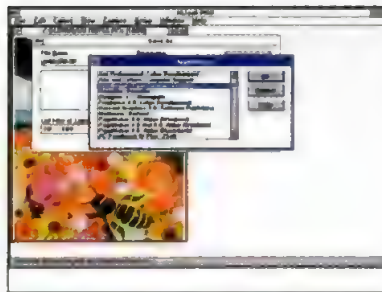
TELL HIM IT'S DORKMAN,
CALLING FROM THE
DORKMOBILE



format to convert to for placing an image in another application; the program handles this for you. If you have an application that uses the Aldus Installable Import Filters, you can even import HiJaak files without leaving your native app. HiJaak is a surefire bet for all but the most esoteric graphics chores.

Inset Systems Inc., 71 Commerce Dr., Brookfield, CT 06804; 800-374-6738. Reviewed: September 28, 1993, page 50.

Circle 466 on reader service card



Smooth conversions
with HIJaak PRO.

.....
Eastman Kodak Co.

Kodak ColorEase PS Printer

BY LEON ERLANGER

With a list price of \$7,999, Kodak's first color PostScript thermal dye transfer printer costs about \$2,000 less than the competition, yet renders some of the finest photo-realistic output we've seen. Printed copies of photos could pass for darkroom prints, and business graphics print with bright, saturated colors on both paper and transparencies. While thermal dye transfer printers often blur the edges of text and thin lines, the Kodak ColorEase PS Printer renders them crisply and cleanly. The cost to print a page, typically between \$2.10 and \$2.60, is also low for units in this class.

The ColorEase's generous configuration boasts 16MB of RAM, a 120MB hard disk (70MB of which can be used as virtual RAM), and Adobe PostScript Level 2. Despite its 40-MHz SPARC RISC processor, the ColorEase is not the fastest printer we've seen in this category. But exceptional color and very competitive price still put this printer out in front. Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14633; 800-344-0006. Reviewed: August 1993, page 56.

Circle 467 on reader service card



Killer color from
Kodak.



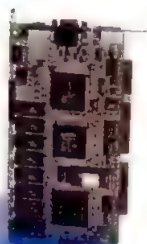
Dynamic ease: FoxPro
and Paradox.

.....
Matrox Electronic Systems Ltd.

Matrox MGA Ultima, ISA Version and VLB Version

BY MICHAEL NEUBARTH

If you're in search of a top-flight video accelerator card, the Matrox MGA Ultima series deserves your attention. For high-end true-color graphics applications like photo editing and 3-D modeling, these



Great video from the
Matrox MGA Ultima.

boards offer terrific performance at a reasonable price. Available in ISA, VL-Bus, MCA, and PCI versions, the Ultimas are feature-rich and easy to install. They're also fast, placing at or near the top on recent PC Magazine Labs tests.

The Ultima family is powered by the company's own 64-bit graphics engine. The ISA and VL-Bus versions support 16.7 million colors at 800-by-600 and 640-by-480 resolution, and 32,768 colors at 1,024-by-768. They are also among the few boards that support up to 1,600-by-1,200 resolution. At lower resolutions, the cards offer a host of features, including hardware pans and zooms.

While the Ultima cards were never intended to compete in the low-cost accelerator market, Matrox recently dropped the price of its ISA and VL-Bus versions from \$899 to \$599, making them much more affordable.

Matrox Electronic Systems Ltd., 1055 St. Regis Blvd., Dorval, Quebec, Canada H9P 2T4; 800-361-1408. Reviewed: December 7, 1993.

Circle 468 on reader service card

.....
Microsoft Corp.

Microsoft FoxPro For Windows

Borland International Inc.

Paradox for Windows, Workgroup Edition

BY SAL RICCIARDI

In a year when many users dove into Microsoft Windows database management, Microsoft and Borland win kudos for making the plunge painless.

If you're looking to port XBase applications from DOS, Microsoft FoxPro 2.5 for Windows (\$495) offers a high degree of XBase-language compatibility and stands out for its development tools and cross-platform support. FoxPro's superb performance on our tests and support for Windows features such as OLE and DDE make it ideal for developers.

For end users, Borland's latest Windows database, the Workgroup Edition of Paradox 4.5 for Windows (\$495), begins with the strengths and innovative graphical features that characterized Paradox for Windows 1.0. The Workgroup Edition adds Borland's Object Exchange (OBEX) technology and strong SQL connectivity.

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400. Reviewed: May 11, 1993, page 144.

Circle 469 on reader service card



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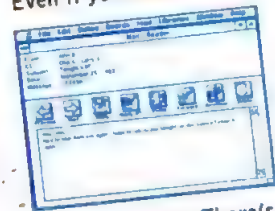
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**Minimum requirements: 386 and Windows 3.1, 4MG RAM. MacPlus/Classic or higher, 4MB RAM.

Borland International Inc., 100 Borland Way, Scotts Valley, CA 95066; 408-461-9000. Paradox for Windows, Version 1.0 reviewed: May 11, 1993, page 156. *Circle 470 on reader service card*

.....
Microsoft Corp.

Microsoft Visual Basic, Professional Edition

Sheridan Software Systems Inc.

VBAssist

BY SHERYL CANTER

When Microsoft Visual Basic was released in 1991, its innovative visual approach turned Microsoft Windows software development on its ear. Others have since copied the paradigm, but Visual Basic, Professional Edition, Version 3.0 (\$495), is still the best at hiding the complexity of Windows programming. New to Version 3.0 are the Microsoft Access database engine, a selection of data-aware controls, and OLE 2.0 support.

Visual Basic's open architecture also lets you seamlessly integrate third-party custom controls. One of the best is Sheridan's VBAssist, Version 3.0 (\$179). With its Code Assistant, Property Assistant, and new Form Wizard, VBAssist makes Visual Basic programming even easier.

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400; 206-882-8080. Reviewed: July 1993, page 42.

Circle 471 on reader service card

Sheridan Software Systems Inc., 35 Pinelawn Rd., Melville, NY 11747; 516-753-0985. VBAssist, Version 2.0 reviewed: May 25, 1993, page 77.

Circle 472 on reader service card

.....
Nanao USA Corp.

Nanao Flexscan F550i-W

NEC Technologies Inc.

NEC MultiSync 4FG

BY JONATHAN HILL

If you're retiring that old 14-inch unit that came with your system, the 17-inch Nanao Flexscan F550i-W is well worth evaluating. Unlike competitors with heavily robotic assembly lines, Nanao relies on the human eye to tune each and every monitor that leaves its plant. The results can only be described in one word: gorgeous. Deep, sharply focused colors, excellent antiglare properties, and intelligent digital control make this \$1,599 unit



Terrific monitors from
NEC and Nanao.

color color-correction software have been widely admired and emulated.

Nanao USA Corp., 23535 Telo Ave., Torrance, CA 90505; 800-632-4636. Reviewed: September 14, 1993, page 191.

Circle 473 on reader service card

NEC Technologies Inc., 1255 Michael Dr., Wood-Dale, IL 60191; 800-388-8888. Reviewed: March 16, 1993, page 153.

Circle 474 on reader service card

.....
NEC Technologies Inc.

NEC Ultralite Versa 25C

Texas Instruments Inc.

TI TravelMate 4000 WinDX2/50

BY DON WILLMOTT

Two notebooks stand out from the crowd that passed through PC Magazine Labs in 1993: the NEC UltraLite Versa 25C (\$4,269) for its aggressive approach toward protecting your investment, and the TI TravelMate 4000 WinDX2/50 (\$3,499) for its raw power and long battery life (it's also available as the Gateway Nomad 450DXL).

The Versa's flexibility and upgradability is most evident in its display. You can buy a monochrome system and upgrade later to active-matrix color. The 25-MHz 486SL-based Versa is an outstanding graphics performer, too, thanks to NEC's local-bus video subsystem.

The Editors' Choice TravelMate, the fastest of a whole family of TI notebooks, is a monochrome model boasting a 5-hour battery life with power management—impressive for such a fast notebook. At just 5.6 pounds, the TravelMate is a power/portability winner.

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-636-4636. Reviewed: August 1993, page 214.



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Tenth Annual Awards for Technical Excellence

The following were honored in our Tenth Annual Awards for Technical Excellence (December 21, 1993).

After Hours

WINNER
Broderbund's Living Books
Broderbund Software Inc.
FINALISTS
Design and Build Your Deck
Books That Work

Kid CAD
Davidson & Associates Inc.

Applications Software

WINNER
Lotus Improv for Windows, Release 2.1
Lotus Development Corp.
FINALISTS
Quattro Pro 5.0 for Windows, Workgroup Edition
Borland International Inc.
WordPerfect 8.0a for DOS
WordPerfect Corp.

Components

WINNER
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Intel Corp.
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Digital Equipment Corp.
Weitek Power 9000
Weitek Corp.

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WINNER
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Apple Computer Inc.
FINALISTS
IBM TrackPoint II
IBM Personal Computer Co.
Microsoft Mouse, Version 2.0
Microsoft Corp.

Development Tools

WINNER
WinScope, Version 1.1
The Periscope Co.
FINALISTS
Bounds-Checker for Windows, Version 2.0
Nu-Mega Technologies Inc.
Microsoft Visual C++, Version 1.1; Microsoft Visual C++ 32-Bit Edition, Version 1.1
Microsoft Corp.

Graphics Software

WINNER
Adobe Acrobat
Adobe Systems Inc.
FINALISTS
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Adobe Systems Inc.

Visio, Version 2.0
Shapeware Corp.

Networking Hardware

WINNER
Wellfleet Backbone Concentrator Node
Wellfleet Communications Inc.
FINALISTS
3Com LinkBuilder Stackable Wiring Hubs
3Com Corp.

Tricord PowerFrame ES5000
Tricord Systems Inc.

Networking Software

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Microsoft Windows NT Advanced Server
Microsoft Corp.
FINALISTS
Conner HSM
Conner Peripherals Inc.

WINview for Networks, Version 2.01
Citrix Systems Inc.

Operating Systems and Software Standards

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Microsoft OLE 2.0
Microsoft Corp.

FINALISTS

Microsoft Windows NT
Microsoft Corp.

NeXTStep 3.1 for Intel Processors
NeXT Inc.

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Hewlett-Packard Co.
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Canon Computer Systems Inc.

Nikon Coolscan Film Scanner LS-10
Nikon Electronic Imaging

Systems

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IBM ThinkPad 700C Family
IBM Personal Computer Co.
FINALISTS
HP OmniBook 300
Hewlett-Packard Co.

ZDS Z-Lite 425L
Zenith Data Systems

Circle 475 on reader service card

Texas Instruments Inc., P.O. Box 202230, Austin, TX 78720; 800-527-3500. Reviewed: August 1993, pages 39 and 182.

Circle 476 on reader service card

.....
IBM Corp.

OS/2, Version 2.1

Symantec Corp.

The Norton Commander For OS/2

BY JOE SALEMI

This year saw the release of IBM's OS/2 2.1 (\$249) and the substantial improvements it brings to this pioneering PC operating system. OS/2, a 32-bit multitasking, multithreaded, graphical OS, now includes support for Microsoft Windows 3.1 applications,

Stronger than ever:
OS/2 2.1.



including TrueType and Windows OLE. It also boasts a 32-bit graphics engine, MPM/2 multimedia extensions, and stronger support for accelerated graphics controllers, SCSI hard disks, CD-ROMs, and other standard hardware.

Version 2.1 still lacks a good file manager, however. Fortunately, Symantec has come to the rescue with The Norton Commander for OS/2, Version 1.0 (\$149), an excellent version of its popular DOS product that makes it easy to delete, move, copy, and generally manage files using OS/2's drag-and-drop capabilities. This package is a must for every OS/2 user's toolkit.

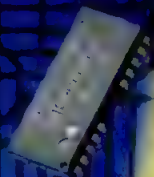
IBM Corp., Old Orchard Rd., Armonk, NY 10504; 800-426-3333. Reviewed: September 14, 1993, page 38.

Circle 477 on reader service card

Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; 800-441-7234. Reviewed: February 23, 1993, page 42.

Circle 478 on reader service card.

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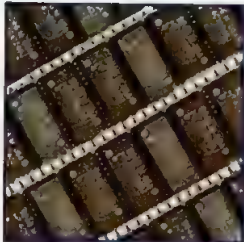
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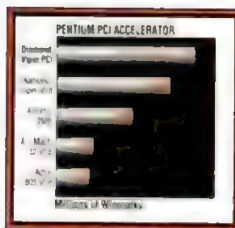
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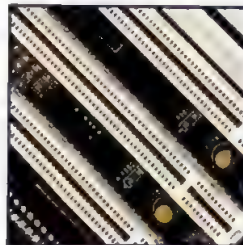
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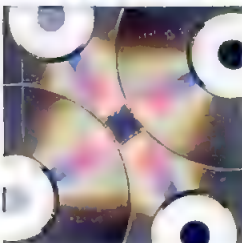
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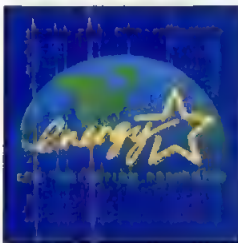
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- Diamond Viper VLB (2MB VRAM)
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- Diamond Viper VLB (2MB VRAM)
- 17" Micron 17FGx, 1280NI, .26mm, MPRII
- Tower Chassis, 300 Watt, 8 drive bays
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Choice of application software

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466VL DESIGNSTATION CD

- Intel 486DX2 66MHz processor
- Pentium Technology Ready (ZIF)
- 16MB RAM, 1.0GB 10ms SCSI-2 HD
- SCSI-2 EISA caching controller w/4MB
- 256K 15ns cache (to 512K), Flash BIOS
- 8 expansion slots: 2 VESA, 8 EISA
- 2X CD-ROM drive, 3.5" floppy
- Diamond Viper VLB (2MB VRAM)
- 17" Micron 17FGx, 1280NI, .26mm, MPRII
- Tower chassis, 300 Watt, 8 drive bays
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Choice of application software

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466PCI WINSTATION CD

- Intel 486DX2 66MHz processor
- Pentium Technology Ready (ZIF)
- 16MB RAM, 340MB 14ms PCI IDE HD
- 256K 15ns write-cache, Flash BIOS
- 8 expansion slots: 3 PCI, 5 ISA
- 2X CD-ROM drive, 3.5" floppy
- Diamond Viper PCI (2MB VRAM)
- 15" Micron 15FG, 1280NI, .28mm, MPRII
- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Choice of application software

\$2,899 LEASE - \$105/MO.

466PCI POWERSTATION CD

- Intel Pentium 60MHz Processor
- 16MB RAM, 527MB 10ms IDE HD
- PCI IDE caching controller w/4MB RAM
- 256K 15ns write-back cache, Flash BIOS
- 8 expansion slots: 3 PCI, 5 ISA
- 2X CD-ROM drive, 3.5" floppy
- Diamond Viper PCI (2MB VRAM)
- 15" Micron 15FG, 1280NI, .28mm, MPRII
- Desktop "Tool Free" chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Choice of application software

\$3,899 LEASE - \$135/MO.

466PCI MAGSERVER CD

- Intel Pentium 60MHz Processor
- 32MB RAM, 1.0GB 10ms SCSI-2 HD
- PCI FAST SCSI-2 controller
- 256K 15ns write-back cache, Flash BIOS
- 8 expansion slots: 3 PCI, 5 ISA
- 2X CD-ROM drive, 3.5" floppy
- Graphics Accelerator (1MB)
- 14" Micron 14FG, 1024NI, .28mm, MPRII
- Tower chassis, 300 Watt, 8 drive bays
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Choice of application software

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CIRCLE 111 ON READER SERVICE CARD
CIRCLE 113 ON LEADERSHIP SERVICE CARD

.....
Systems Compatibility Corp.

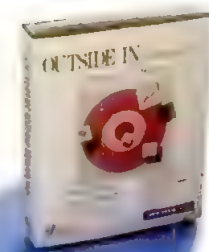
Outside-In for Windows

BY JIM SEYMOUR

The hardest thing about the \$89 Outside-In for Windows, Version 2.1, is describing it succinctly. At its core, this Ronco-matic utility is a collection of sensationally good viewers for files created by over 120 different word processors, spreadsheets, graphics packages, and other PC applications.

But wait, there's more! Outside-In lets you move information between files via the Windows Clipboard while retaining most formatting. Because it lets you graphically choose the part of the file you're copying, it's fast to use and works better than using your app's Import or Place features.

Still not enough? Outside-In also lets you select all or any part of any file in any of its viewers and print the selection, fully formatted, without the original



Outside-In's sensational viewers.

app. It works even from within File Manager, which for many users it will effectively replace.

Systems Compatibility Corp., 401 N. Wabash, #600, Chicago, IL 60611; 312-329-0700. Version 2.0 reviewed: February 9, 1993, page 44.

Circle 479 on reader service card

.....
Central Point Software Inc.

PC Tools for Windows

BY EDWARD MENDELSON

Version 2.0 of PC Tools for Windows contains the most thorough and well-designed alternative Microsoft Windows desktop on the market. And even if you don't want to replace the default Windows desktop, you'll want the safety and convenience of the included utilities. For \$179.95, Central Point gives you a highly customizable screen, multiple desktops, the best available Windows file manager, one of the best Windows macro and scripting utilities, and a complete backup program that works with floppy disk drives and QIC or SCSI tapes. You also get a disk defragmenter that works in the background and the first Windows-based disk-repair utility.



Windows tools from Central Point.

PC Tools' replacement for the Windows desktop is customizable for either a completely new look or the same one you're used to. No matter what Windows utilities you already use, you will find something extra in PC Tools for Windows.

Central Point Software Inc., 15220 N.W. Greenbrier Pkwy., Beaverton, OR 97006; 800-445-4208. Reviewed: September 14, 1993, page 149.

Circle 480 on reader service card

.....
North Coast Software Inc.

PhotoMorph

BY JOHN R. QUAIN

The popularity of computer-generated science-fiction movie effects has introduced morphing to the vernacular—and to the desktop PC. In 1993, Version 1.2 of PhotoMorph was the best of a half-dozen new programs that seamlessly transform one graphics image into another.

Novices will find that creating a smooth morph of, say, a young woman's face that turns into an old man's face, takes a fair amount of practice. But the \$149.95 PhotoMorph goes beyond its competitors to make the task easy. PhotoMorph displays the source and destination images side by side while you set the

.....
MULTIMEDIA

Making Noise

We pick the best hardware for serious audio.

This was the year when high-quality PC audio went mainstream. Among the many available sound cards, the \$599 **Turtle Beach MultiSound** stands out for the best professional-quality digital recording and playback, as well as the best synthesis we've heard (Turtle Beach Systems, 717-767-0200). Tests at PC Magazine Labs showed that this 16-bit sampling board possesses a virtually flat



Turtle Beach MultiSound.

frequency response curve, 44.1-kHz recording for full CD quality, and harmonic distortion that rivals component stereo equipment. The MultiSound's Hurricane Architecture and a Motorola 56001 DSP make for speedy throughput without DMA bottlenecks.

Of course, a great sound board won't produce dulcet tones without good speakers. For a multimedia PC, speakers need their own built-in power amplifier and magnetic shielding to prevent interference with your monitor.

Although a horde of new models was introduced last year, the best is still the \$400 **Altec Lansing Multimedia ACS300** computer speaker system, consisting of two clamshell-style speakers and a subwoofer (Altec Lansing, 800-258-3288). If you can't afford \$400 speakers, a good midprice option is Yamaha's 10-watt-per-channel **Yamaha YST-M10** pair, retailing at about \$100 through dealers.



Altec Lansing Multimedia ACS300.

—John R. Quain and Michael Zulich

morphing points, and it can handle morphs between images of different sizes and color depths, and in a variety of formats. A mouse click is all you need to design a warp (a distorted image), select transition effects, or superimpose a title. And it can generate an animated morph transition in less than half the time needed by some other programs. PhotoMorph also includes a suite of predesigned, canned special effects such as swirls, spheres, and ripples to create instant digital graffiti.

North Coast Software Inc., P.O. Box 459, Barrington, NH 03825; 603-664-6000. Reviewed: October 26, 1993, page 47.

Circle 481 on reader service card

.....
Pixar

Pixar Typestry

BY GAYLE C. EHRENMAN

With Version 1.1 of Pixar Typestry (\$299), you don't have to be a graphic artist to create professional-looking, attention-grabbing type effects in Microsoft Windows. There are few controls to master, the interface is intuitive, and the self-explanatory tools make generating 3-D effects a breeze. Simply type your message in a dialog box, choose any Type 1 or TrueType font loaded on your system, set the bevel style and depth, and click on the Build Object button. Once the text object is extruded, you can assign 1 of the 24 looks (marble, metal, wood, and so on) to the entire word or just a single letter, add a floor or wall for background, adjust the lighting, and render it. Rendering is fast and attractive, thanks to Pixar's RenderMan software, and you can use your extruded words to create keyframes for producing a simple Autodesk Animator movie.

Pixar, 1001 W. Cutting Blvd., Richmond, CA 94804; 800-888-9856, 510-236-4000. Reviewed: April 13, 1993, page 44.

Circle 482 on reader service card

.....
Powersoft Corp.

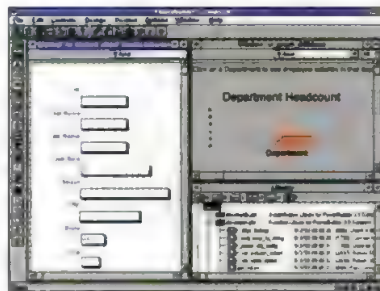
PowerBuilder

BY SHERYL CANTER

You can pay less, but you won't find a more efficient 4GL programming tool than Version 3.0 of PowerBuilder (\$3,595) for creating database front ends in Microsoft Windows. PowerBuilder always support-



World effects with
PhotoMorph.



PowerBuilder: Front
ends made easy.



Click that type with
Pixar Typestry.

ed a multitude of back ends, but the newest version adds IBM's DRDA and Microsoft's ODBC, for connectivity to almost any database. Its rich feature set now includes a powerful report writer, built-in business graphics, and a configurable toolbar.

A highly consistent interface makes it easy to navigate through the package's many features. PowerBuilder is organized around functional modules called Painters that let you create and edit various parts of your application. All application components are stored in a library, which is housed either locally or on the server. PowerBuilder is object-oriented, so application components can be inherited from other components. Event-driven scripts that use a BASIC-like syntax are attached to the user

interface by double-clicking on interface objects. PowerBuilder is easy to learn, offers strong connectivity, and boasts virtually every feature you could possibly want.

Powersoft Corp., 70 Blanchard Rd., Burlington, MA 01803; 800-395-3525. Reviewed: November 9, 1993, page 264.

Circle 483 on reader service card

.....
Practical Peripherals Inc.

Practical Peripherals PM14400FX PKT

BY THOMAS MACE

If you've found that portable 14,400-bit-per-second modems are an oxymoron, this unit will convert you. You would be hard pressed to find a smaller, more convenient traveling modem than the \$499 Practical Peripherals PM14400FX PKT. This tiny unit packs it all into a tough, 4.2-ounce case: blazing V.32bis speed, V.42 error correction, V.42bis compression (for up to 57,600-bps host-to-host throughput), 14,400-bps send/receive faxing—even eight status LEDs and a speaker. It was a fast, reliable performer on our tests, even under impaired line conditions. This modem draws power from its tiny AC adapter or a feather-light AA battery pack. The modem, supplied serial cable, AC adapter, and battery pack all slip into a handsome, padded case for penalty-free portability.

Practical Peripherals Inc., 375 Conejo Ridge Ave., Thousand Oaks, CA 91361; 800-442-4774. Reviewed: June 29, 1993, page 243.

Circle 484 on reader service card.



Practical
Peripherals'
tiny pocket
modem.

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Thumbs Up, Thumbs Down

Once again, contributing editor Jim Seymour casts a critical eye on the year gone by.

 **Thumbs Down to Lou Gerstner**, IBM's new chief, for his midyear remark that "the last thing IBM needs now is a vision." Sure, Lou, hoarding cash and being more efficient are important—but as any IBM customer or employee can tell you, restoring the sense that IBM knows where it's headed is just as important.

 **Thumbs Up to Hewlett-Packard** for reminding us, with the HP OmniBook 300, that a small size and light weight are what notebook PCs are all about.

 **Thumbs Down to Hewlett-Packard** for not having an infrared receiver for desktop PCs ready to ship with the OmniBook 300, and for the cheesy stunt of making users install LapLink Remote on their desktop PCs via the OmniBook's serial cable.

 **Thumbs Up to PC makers** that decided to lead, rather than follow, the market this year by making CD-ROM drives standard features with most of their machines.

 **Thumbs Down to PC makers** that stuck cheap, slow CD-ROM drives in their PCs when they made them standard. Giving CD-ROMs a bad name isn't exactly market leadership, guys.

 **Thumbs Down to the raft of genuinely weird notebook PC add-ons** that appeared, to our delight and puzzlement, in 1993. The field is so rich and varied that it's unfair to award the Fickle Thumb of Fate to the makers of any one of them, but the company that produced a little sling-like desk that attaches to the steering wheel of your car, so you can hang your notebook in front of you and work as you drive, earned a

very special spot in our hearts. Drive carefully!

 **Thumbs Down to the graphics board vendors** who got caught cheating this year on PC Magazine Labs' video benchmark tests, by embedding hard-coded character strings from the tests in their firmware. C'mon, guys: did you really think we wouldn't notice?

 **Thumbs Down and Not Yet Ready for Prime Time, Part 1, to Microsoft** for the AVI (audio-video interleave) approach of Video for Windows. Sure there are problems to overcome in putting video on-screen with today's not-up-to-the-job CPUs, but letting the sound slowly slip out of sync with the picture isn't a very smart answer.

 **Thumbs Up to IBM** for OS/2 2.1. Big Blue had lots of hits this year, but few of them were as important to the company's self respect as this clean-up of its once-laughable PC operating system. OS/2 turned the corner with Version 2.0 and became genuinely usable with 2.1.

 **Thumbs Up to the modem industry** for making 14,400-bit-per-second modems the new standard, at prices which, almost from their introduction, undercut the 9,600-bps units that we'd been stuck with for too long. Now deliver V.FAST—fast.

 **Thumbs Down to Microsoft** for its confusion over just who was supposed to buy Windows NT. "It's for desktop PCs! No, it's for servers! No, it's for..."

 **Thumbs Up to all the vendors** that brought out squirrely little gizmos to make desktop PCs safer and,

allegedly, more ergonomically user-friendly. From tiny wrist pads for trackballs to arm brackets to little wiggly things we rub our feet on, you gave us a lot of laughs this year, if not a lot of relief.

 **Thumbs Down and Not Yet Ready for Prime Time, Part 2, to Apple** for the Newton MessagePad. It's almost small enough, almost cheap enough, almost reliable enough, and of course the handwriting recognition is almost cGhet)s blur bish.

 **Thumbs Down to Compaq** for not leaving room for a CD-ROM drive in its otherwise intelligently designed all-in-one Presario. Was leaving the hottest, most popular home-PC peripheral out of your newest home PC part of that "we're going to be the market leader" plan, Eckhard? Hmmm...?

 **Thumbs Down and Not Yet Ready for Prime Time, Part 3, to WordPerfect** (WP/DOS 6.0), **Novell** (NetWare 4.0), **Polaris** (PackRat 5.0), and all the other software vendors that this year shipped new products with bugs so bad that quick-fix upgrades had to be rushed out to make 'em usable.

 **Thumbs Up to those PC vendors** who embraced the Department of Energy's EnergyStar power-saving PCs plan. We know Kermit was right when he told us "it isn't easy being green," and we appreciate the effort.

 **Thumbs Down to the CD-ROM makers** and resellers who lard in with their drives "free" disk bundles full of such ooze as Mongolian Health Surveys, 1925-1935 and Shareware of the Hollywood Stars. It's quality, not quantity, that counts.

Quark Inc.

QuarkXPress for Windows

Microsoft Corp.

Microsoft Publisher

BY LUISA SIMONE

Version 3.12 of QuarkXPress for Windows is an amazingly powerful, incredibly precise, and exceptionally flexible page design tool. A short list of typographic features includes its ability to spec type in .001-point increments and adjust tracking by 1/20,000th of an em. And the design tools, such as grouping, gradient blends, and free rotation of text or graphics, make short work of complex layouts and special effects. Priced at \$895, QuarkXPress is unapologetically targeted at professionals. But features like its ability to store 127 master pages per document, control how colors trap to one another on press, or directly produce four-color separations are essential for high-volume, production-oriented studios.

For business users, Microsoft Publisher, Version 2.0, costs only \$139 and provides all the desktop publishing power most of us need. It also boasts several unique features such as PageWizards for automating document design and WordArt for creating logos and special type effects. Quark Inc., 1800 Grant St., Denver, CO 80203; 800-788-7835. Reviewed: February 9, 1993, page 252.

Circle 485 on reader service card

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400. Reviewed: October 26, 1993, page 44.

Circle 486 on reader service card

SuperMac Corp.

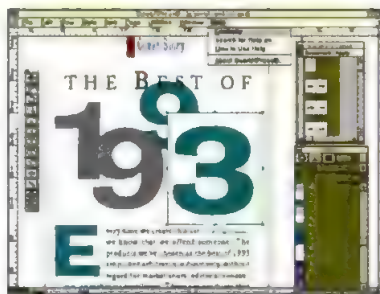
SuperMatch System

BY JEFF MACE

SuperMac's SuperMatch line of monitors, video cards, and color-calibration tools for the PC represents a real advance for professionals working with 24-bit color in applications like Adobe Photoshop and QuarkXPress. Together they address the long-standing problem of matching variable monitor hues with strict prepress color specifications. We were particularly impressed by the SuperMatch Spectrum/24 24-bit video card and SuperMatch 20-TXL monitor calibrated using the SuperMatch



SuperMac's 24-bit color specialists.



Professional pages with QuarkXPress.



The Tandy Zoomer.

Calibrator Pro.

The \$999 Spectrum/24, for 24-bit color work only, installs easily and supports resolutions up to 1,152-by-910. A superb performer, it turned in outstanding Graphics WinMark scores on our benchmark tests.

The Calibrator Pro (also \$999), a sensor that attaches to your monitor via a suction cup, interacts with the Spectrum/24's digital-to-analog converter to deliver accurate screen-color calibration. The Calibrator Pro works with all monitors, but must be connected to either the SuperMatch Spectrum/24 or Thunder/24 series boards.

The handsome SuperMatch 20-TXL (\$2,999) boasts a Sony Trinitron tube with a 19-inch-viewable screen, a 6,500-degree Kelvin white point, and a 0.31 dot pitch. Together, these three products add up to a solid foundation for working with 24-bit color. SuperMac Corp., 85 Potrero Ave., Sunnyvale, CA 94086; 800-541-7680. Spectrum/24 reviewed: June 15, 1993, page 44.

Circle 487 on reader service card

Casio Inc.

Z-7000

Tandy/Radio Shack Corp.

Zoomer Personal Digital Assistant

BY MICHAEL NEUBARTH

Personal digital assistants were chic in 1993. But while the Apple Newton MessagePad grabbed the limelight, Casio and Tandy quietly released their co-manufactured PDA, marketed as the Z-7000 by Casio and the Zoomer Personal Digital Assistant by Tandy.

The \$699 unit is akin to the Newton in look and feel, but it beats the Newton in out-of-box functionality and battery life. While both products are useful for date tracking, note taking, and communicating, the Casio/Tandy entry also comes with games, information databases, Intuit's Pocket Quicken personal finance package, and an interface to America On-Line already installed. Better handwriting recognition and a more powerful processor remain on our wish list, but this first incarnation of the Z-7000/Zoomer still goes a long way toward making the PDA a mainstream mainstay.

Casio Inc., 570 Mt. Pleasant Ave., Dover, NJ 07801; 201-361-5400.

Tandy/Radio Shack Corp., 700 One Tandy Center, Fort Worth, TX 76102; 817-390-3011. Reviewed: October 12, 1993, page 174.

Circle 488 on reader service card

RUNNING WINDOWS NORTON DESKTOP SWIM AFTER AND THEN R THE POOL WITH



Listen up, you risk-takers. What would your mother say if she saw you now?

No doubt she would tell you to get the new Norton Desktop 3.0 for Windows before you hurt yourself. Or your computer.

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Made by Peter Norton, it's packed full of utilities to provide a safer working environment.

Like our new Norton AntiVirus 3.0, which protects your system against over 2,300 known viruses, and our new Norton Backup™ 3.0 with enhanced support for SCSI drives. There's also the new UnErase, to recover accidentally erased files. Disk Doctor for automatic disk diagnosis and repair. And a Fix-It disk with a full collection of DOS utilities to recover and repair files or entire disks, even if you can't run Windows. And now

For information in Europe, call 31-24-953111. Australia, 61-2-879-8577. Canada, 1-800-667-8861. Elsewhere outside U.S., 408-252-3570. The Norton AntiVirus and Norton Disk

OWNS WITHOUT ? YOU PROBABLY A BIG MEAL UN AROUND SCISSORS, TOO.

for the first time you'll be able to run Speed Disk under Windows to boost performance.

In addition, NDW 3.0 simplifies Windows for you by integrating file and program management. And while the new FileAssist will allow you to easily manage your files without having to leave your applications, the new Day Planner will allow you to easily manage your life.

Plus, the new "push button" Control Center lets you customize pull-down menus, icons, toolbars and more to make Windows look and work the way you want it to.

So the choice is yours. Either see your local dealer, call 1-800-628-4777, ext. BG85 to order, or live a life of danger and recklessness, running Windows without Norton Desktop 3.0 for Windows and sprinting around pools with sharp objects until you put somebody's eye out.

Of course, you would be absolutely crazy not to get NDW 3.0. And remember, don't run Windows without it!

**THE NORTON
DESKTOP**
FOR WINDOWS
SYMANTEC.

Doctor are registered trademarks and Norton BackUp, Norton Desktop and Speed Disk are trademarks of Symantec Corporation. ©1993 Symantec Corporation. All rights reserved.

THE BEST OF Abort, Retry, Fail?

Say good-bye to sticky sprays and messy powders! Enjoy this ergonomic, object-oriented, high-resolution, WYSIWYG look at 1993's wackiest moments in computing, and then use it to cover your embarrassing bald spots.

by Don Willmott

Jump! Jump! Jump!

In 1993, ATI, Computer Associates, and Information Builders all took their ads to the edge. We don't know what this says about the state of American business today, but we're getting a little jumpy.



A New Kind of Computer Whiz

We thought the famous Logitech baby and his golden data stream would be unchallenged in the Wee-Wee Hall of Fame until we saw this ad from Video Seven. Move over, Junior; make some room. And let's drink to 1994. (Or maybe let's not.) Meanwhile, you can be sure that Logitech will plan another big splash for 1994.

Personal Ad of the Year

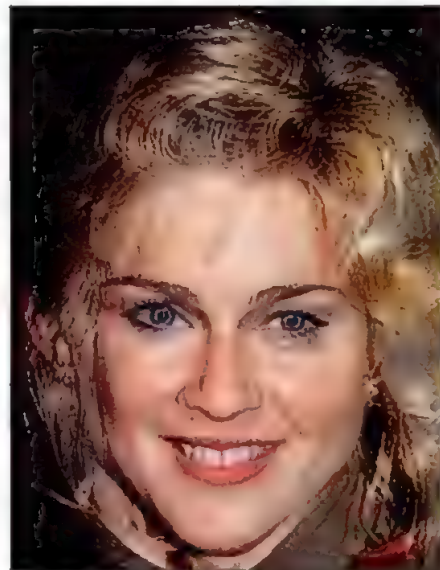
BOX#545
WANTED A good man who can read, write, pull weeds, cook, and owns a good hard-drive computer and printer. Please enclose photo of computer and printer BOX#534
WWF, attractive, young, 70, 5'6", 155lbs, would like to meet.

Attention Beavis and Butt-Head!!!

The strangest character to cross our path this year was The Great Kat, a diminutive, Julliard-trained classical musician who rebelled at all that stuffy pretension and is now devoting her life to performing classical masterworks in speed metal style. We wish the delightfully foul-mouthed Kat luck in producing her upcoming multimedia CD-ROM extravaganza. In the meantime, we'll sit back and enjoy some of our favorite cuts off her *Beethoven on Speed* CD: "Ultra-Dead," "Sex and Violins," "Gripping Obsession" and "Guitar Concerto in Blood Minor."



Why Live Your Life when You can



Morph-a-rama The hot new software category in 1993 was morphing software. The morphmasters at North Coast Software used their program, PhotoMorph, to help us combine some photos of famous faces. Can you guess which two celebrities have been morphed together in each image? (Answers below.)

Best New Font of the Year

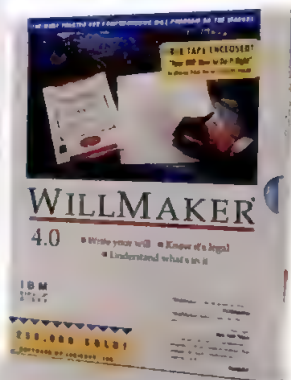
**Here's the story...of a lovely lady...
Who was bringing up three
very lovely girls...**

You've got to hand it to SWFTE International. Not only did the Typecase III type collection include the font that appeared in the opening credits of *The Brady Bunch*, the company even named it "Jan Brady," an honor that warms the hearts of middle children everywhere. And Jan, 20 years later we still think your glasses were groovy, no matter what Bobby said. He was a stinker anyway.

Public Relations 101

June 9, 1993: Computer Associates announces that it will give away free copies of its new personal finance software, Kiplinger's CA-Simply Money, to the first one million people who call. Soon the phone lines are jammed, callers can't get through, and chaos ensues. Big problem, right?

June 10, 1993: Computer Associates issues a press release bragging about its inability to answer all the phone calls. Included is a photo of harried operators sitting at phone banks, trying in vain to keep up with the calls.



Separated at Birth?



Wired Communicator
H. Ross Perot



Wireless Communicator
AT&T EO 440

Compute It?

Answers to morph Quiz: 1. Michael Jackson/Elizabeth Taylor 2. Cindy Crawford/Jimmy Durante 3. Tipper Gore/Madonna
Photo credits: Liz: Bill Davila, Retna Ltd. Michael: Bill Davila, Retna Ltd. Cindy: Steve Granitz Retna Ltd. Jimmy: Photofest
Tipper: Walter McBride, Retna Ltd. Ross: Photofest
Winners this issue: D.R. Aton, Gene Lauver

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[Sharp PC-8650 LCD Color Notebook]



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Wherever you work, you could be more impressive with a 256-color, TFT Active Matrix LCD Display. From Sharp, the leader in LCD. You could be more powerful with a 486DX 33 MHz, SL-enhanced processor with Power Management. And 4MB RAM expandable to 20MB. More productive with a 200MB fast-access hard drive with MS-DOS® 6.0 & Windows® 3.1 pre-installed. Plus a conveniently located front plug-in trackball. Not to mention more versatile with a PCMCIA Type II slot. You'd even be more financially wise at \$3,699 (MSRP). The new Sharp PC-8650. Whether you're en route or at home, it's got more ways to make anyplace, your workplace.

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CIRCLE 161 ON READER SERVICE CARD

THE Whole Picture

Over 12,000 *PC Magazine* readers rate their desktop and laptop PCs, printers, and monitors.

by Joel Dreyfuss

Ideally, owning a piece of computer equipment should be as painless as owning that perfect automobile. You want to be able to step into your vehicle, turn the key, and go roaring down the road every time with no more attention paid to the car than occasionally making a stop to refill the gas tank, change the oil, or empty the ashtrays.

Our latest Service & Reliability surveys of *PC Magazine* subscribers indicate that for the most part, computer owners enjoy a blissful and trouble-free experience with their PCs, printers, and monitors. Respondents generally reported a degree of reliability high enough to cause envy in the auto-making capitals of the world.

The real drama begins when something goes wrong. There's that panicked moment when you turn the machine on and nothing happens, or when your printer suddenly stops working, or when your screen goes dark. A company can jeopardize its relationship with a computer customer, who tends to take a high degree of reliability for granted, by responding slowly or poorly to his or her plea for help.





Hardware Ratings

How We Surveyed

Our latest Service & Reliability survey questionnaire was mailed to a random sample of 24,500 *PC Magazine* subscribers—17,000 surveys were mailed in July 1993 and covered desktop and notebook PCs; 7,500 surveys were mailed in May 1993, covering printers and monitors.

DESKTOP AND NOTEBOOK PCs

Our survey of desktop and notebook PCs closed on September 10, 1993, by which time we had received a 50 percent response. The reported data is based on the responses in the 8,522 returned, usable questionnaires, as tabulated by Willard & Shullman, a research firm in Greenwich, Connecticut. (The post office returned 124 questionnaires to us as undeliverable.)

We asked subscribers to describe each of the desktop and notebook PCs they had used in the past two years, up to a maximum of five systems. Next, respondents rated the reliability of each PC, and their satisfaction with their repair experience and technical support received. Respondents also indicated the number of days each PC was unusable because of hardware problems; which components, if any, needed repair; and the likelihood of their buying new PCs from the same vendor in the future.

PRINTERS AND MONITORS

On July 21, 1993, we closed our printer and monitor survey, when we had received a 51 percent response. Reported data is based on the responses in the 3,736 returned, usable questionnaires, as tabulated by Willard & Shullman. (The post office returned 102 surveys.)

Respondents rated up to five printers and up to five monitors used in the past two years regarding reliability, satisfaction with repair and technical support, and the likelihood of purchasing from the same vendor in the future.

MAKING SENSE OF THE RESPONSES

To analyze results, we focused on one measure (survey question) at a time and calculated a score for each vendor—the mean average of the vendor's ratings on that measure. (Only vendors that received at least 50 responses were included in the final tabulations.) As a standard basis of comparison, we calculated an overall average for each measure by adding each vendor's score and dividing by the number of vendors. Thus, we were able to obtain an average score that is not weighted by market share.

STATISTICAL METHODOLOGY

We compared the vendors' scores against the average using a standard t-test of means. Such a test takes into account the scores, the amount of dispersion among the scores, and the sample sizes. T-tests tell us whether the difference between two scores is large enough to be considered statistically significant at the 95 percent confidence level. This means that if we were to conduct the same study in the same manner 100 times, we could expect the differences reported here to appear at least 95 times. T-tests can sometimes produce anomalous results where two scores that appear close may in fact be significantly different. T-tests can also reveal no statistically significant difference between two scores that seem far apart. It is possible for one product to appear in the average range while another with the same score emerges as significantly above the average. These results are a function of the objective, evaluative components of a t-test of means.

SERVICE OVER THE YEARS

We began exploring the issues of service and reliability four years ago with a survey that was bound into every copy of an issue of *PC Magazine*. We have since then refined our methodology to make the survey more rigorous and to cover a broader range of topics. Among the most important improvements is that we now mail ballots to a random sample of subscribers.

The surveys are meant to explore how satisfied owners are with the equipment they use, the support they receive, and, in the event their equipment fails, the amount of time it takes for the repair. We tabulate the results after we receive at least 50 percent of the ballots back from subscribers, and report on those vendors for which we receive at least 50 responses. In our opinion, this is the minimum number of completed surveys needed to ensure that the data is statistically reliable.

In the three stories that follow, we report on your experiences with service and reliability for desktop and portable PCs, printers, and monitors. In each of our surveys, we asked our respondents to rate the vendors according to three criteria: reliability, satisfaction with technical support, and satisfaction with repair experience. The grades that appear in the Readers' Report Cards result from vendors' performance on these three measures.

A fourth measure, the likelihood that the subscriber would again buy a desktop or laptop PC, printer, or monitor from the same vendor, is not included in the grades on our Readers' Report Cards. This measure may involve user perceptions not directly attributable to experience with service and reliability, such as a respondent's perception of a vendor's financial stability. However, we do discuss it in cases where it is relevant.

Readers were also queried on specific subjects relating to desktop and notebook PCs, printers, and monitors. On the PC survey, respondents were asked to list the chip type of each PC used over the past two years; which components, if any, needed repair; and the number of days a machine was rendered unusable due to repair.

On the printer/monitor survey, we

asked printer users about the type of printers they used and their speed, color capabilities and network connections, as well as users' satisfaction with ten specific printer functions, including speed and the quality of the output when printing text.

Those responding to the monitor portion of the survey answered questions about the monitor's maximum resolution, its size, and whether it was purchased separately or as part of a system. Monitor users were also questioned about their satisfaction with seven specific monitor characteristics, including image clarity and level of glare.

Although the answers to these additional questions do not factor into a vendor's grades on our Readers' Report Card, they can be seen as indications of the present state of each respective market. Comments on these specific subjects appear in the following pages.

STATISTICAL METHODOLOGY

These surveys were conducted during the summer of 1993 (for more information, see "How We Surveyed"). The printer and monitor surveys were mailed together in May 1993 and we stopped tallying votes on July 21, 1993. The desktop and portable PC survey went out in July 1993 and the tally of responses was cut off on September 10. For the PC survey, for which there are literally hundreds of vendors, we mailed questionnaires to 17,000 subscribers. For printers and monitors, 7,500 subscribers were sent questionnaires.

We have categorized each vendor's rating on a particular measure as above the average, average, or below the average when compared to all other rated vendors in each product category. In addition, we have converted the ratings to letter grades that summarize the results for each vendor.

A vendor that received above-average ratings in all three categories—reliability, satisfaction with technical support, and satisfaction with repair experience—gets an A and wins our Readers' Choice award. Readers' Choice winners are the

vendors that continually go out of their way to satisfy customers after the product has been sold.

- A grade of B goes to vendors that received a combination of average and above-average ratings, showing that their level of reliability, service, and support is much higher than most.

- A grade of C goes to vendors with three average ratings or a combination of above- and below-average ratings. This grade denotes those vendors that are still in need of significant improvement.

- D means reader satisfaction with a vendor is below the average, the result of a combination of average and below-average ratings.

- A grade of E means poor. Vendors in this category received below-average ratings in all three key areas.

Vendors in these two final classes are in need of substantial improvement on the service and technical support front.

THE BEST

Some survey results are consistent across product types. On a scale of 1 to 10, monitor, printer, and desktop and notebook PC manufacturers all received high ratings, with average scores in the range of 8 to 9. Computer products may be pretty complex, but they seem to work most of the time.

There are consistencies on the downside as well. In all three product categories, vendors did not fare as well when it came to satisfaction with technical support or repair experience as they did in terms of reliability. Our respondents gave desktop vendors an average rating of 7.2 for satisfaction with technical support and 7.6 for satisfaction with repair experience. Laptop vendors did not do as well. They rated 7.1 for both technical support and repair experience.

The lower scores for portable computers have been consistent in our previous surveys. We believe that they are the result of a number of factors. For one, laptops and notebooks have a tendency to get banged around a lot more than PCs. Second, most vendors don't build their own laptops and notebooks; they contract

with outsiders to design and build their portable PCs. For some, selling notebook means simply slapping their nameplates on the cases. And when you don't make the notebooks yourself, technical support and good repair service are more difficult to maintain.

TOP MARKS

Vendors who score well in the desktop category don't always do well with their laptops, and vice versa. In our latest survey, only Gateway 2000 gets our highest rating in both the desktop and laptop categories. While Apple Computer and Compaq Computer Corp. get the highest ratings for their notebooks, they end up in the second tier for their desktop systems.

There are no guarantees in these rankings. Some companies have changed places with each successive survey. Obviously, they have to earn your satisfaction. For desktop PCs, Dell Computer Corp., Gateway, Swan Technologies, and ZEOS International have consistently earned top scores in satisfaction. This time around, Hewlett-Packard Co. moved into the top tier. For portable PCs, Compaq has earned top marks on three successive surveys.

Among printer vendors, Hewlett-Packard, which dominates the market for laser printers, remains on top, joined by Epson America. But others moved down in the ratings, including Lexmark International, NEC Technologies, and Panasonic Communications & Systems Co.

Survey participants reported a high level of satisfaction with their monitors. In this survey, MAG InnoVision and NEC win Readers' Choice awards. But also in this product category, the average ratings for technical support and repair experience were much lower than scores for reliability.

The message to companies from *PC Magazine* readers is clear. A lot of the products leaving the factory are very good. But when something goes wrong, many vendors stumble. The frontier of after-sale support provides an opportunity for companies to distinguish themselves. Earning a reputation for high-quality technical support and repair service can turn the heads—and open the wallets—of our very demanding readers.

Our Contributors: JOEL DREYFUSS is editor at *PC Magazine*. RACHEL DARBY-TEITLER conducts surveys for Ziff-Davis. TIN ALBANO is a staff editor, and BRIAN NADEL is an associate editor at *PC Magazine*.



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P C s :

Growth and Satisfaction

by Rachel Derby Teitler and Brian Nadel



By any measure, 1993 was a banner year for the PC industry: More systems were sold than ever before, and amid a price free-fall, the level of features and performance delivered to the buyer has never been higher. Manufacturers today have to do

more than deliver a defect-free system: They must strive to improve and expand their ability to service and repair these products.

Our most recent Service & Reliability survey of over 21,000 desktop and more than 5,400 laptop PCs shows that readers continue to be pleased with their systems and rate them as highly reliable, with average reliability ratings

for both desktops and portables of 8.2 on a scale of 1 (worst) to 10 (best). The good news on the reliability front is tempered, though, by lower levels of satisfaction with technical support and repair experiences. Average ratings for these measures are 7.2 and 7.6, respectively, for desktops and 7.1 for both measures for portables. Since our last survey, however, twice as many ven-

dors moved down on the PC ladder of satisfaction as rose.

DESKTOP LEADERS

For the third straight survey, Dell Computer Corp., Gateway 2000, Swan Technologies, and ZEOS International received above-average scores on each of the three key measures of our survey. They are joined this time by Hewlett-Packard Co., whose rating for satisfaction with repair moved up a notch to above the average. These five vendors receive an A on our Readers' Report Card.

Sean Burke, director of product marketing and planning at Dell, explains the vendor's position on supporting PCs: "Service and support are absolutely key today. It is a way we can differentiate ourselves from the rest of the PC industry."

HIGHLIGHTS

Service & Reliability: Desktop and Laptop PCs

SERVICE AND RELIABILITY are becoming more important to vendors as they strive to differentiate themselves from others in an ever-increasing, ever-similar pack. *PC Magazine* surveyed 17,000 readers, and the over 8,500 responses we received cover 34 desktop vendors and 20 laptop vendors. Although the average scores for reliability show that readers are generally happy with their machines, their levels of satisfaction with repair and technical support were somewhat lower.

THE SERVICE AND RELIABILITY survey covered reliability, satisfaction with repair experience, and satisfaction with technical support. Scores were tabulated and grouped into categories of above the average, average, and below the average. Each vendor was given a letter grade based on our readers' responses.

THE DESKTOP HONOR ROLL includes Dell, Gateway, Hewlett-Packard, Swan, and ZEOS, each earning an A on our Readers' Report Card. Each

vendor scored significantly above the average on the three key measures. New class member Hewlett-Packard moved up a notch in satisfaction with repair experiences to join this lofty group.

THE LAPTOP ELITE comprises Apple, Compaq, and Gateway. Gateway improved its grade from average across the board in our last survey to A status this time around. It is also the only vendor at the head of both the desktop and laptop classes.



READERS' CHOICE

- **Desktop vendors:** **Dell, Gateway, Hewlett-Packard, Swan, ZEOS**
- **Laptop vendors:** **Apple, Compaq, Gateway**

The winners of our Readers' Choice awards are vendors that our readers rated significantly above the average on all three key measures of our Service & Reliability survey: overall reliability, satisfaction with

repair experience, and satisfaction with technical support.

Dell, Gateway, Swan, and ZEOS continue their traditions of excellence in the minds of our readers, once again placing among the elite in the desktop category. They are joined by Hewlett-Packard, which rose a notch since our last survey, due to a jump to above the average in the satisfaction with technical support category. In the laptop computers arena, long-time favorite Compaq now shares the top spot with Apple and Gateway. Gateway is the

only vendor in this survey that earned an A on our Readers' Report Card in both the desktop and laptop categories.

Other vendors worthy of mention here include Apple, AST, Austin, Compaq, Digital, IBM, Micron, and Northgate in the desktop division, and Dell, Digital, IBM, and Toshiba for laptops. Each of these vendors collected a combination of significantly above-average and average scores on our survey. All earned grades of B on our Readers' Report Card.

During 1993, Dell consistently increased the staffing of its technical service lines and offers a \$25 reward if the customer waits on the telephone for more than five minutes.

Apple Computer, AST Research, Austin Computer Systems, Compaq Computer Corp., Digital Equipment Corp., IBM Personal Computer Co., Micron Computer, and Northgate Computer Systems each had a mixture of above-average and average scores, earning each a B. With the exception of Digital and Northgate, each received an above-average score for reliability. Only IBM and Northgate received above-average scores for satisfaction with repair experience, while Compaq, Digital, Micron, and Northgate each enjoy an above-average rating for satisfaction with technical support.

While a B is admirable, Austin, Compaq, and Northgate all finished on top in the last survey, and drop into the second tier here. For Northgate, which has struggled with financial and production problems, this comes after two appearances in the top category. Austin's rating

for reliability remains above the average, but the Texas-based PC marketer, which was purchased by Singapore-based IPC Corporation in January 1993, fell to average in terms of satisfaction with both repair experience and technical support. The new owners have stated that improving service and support is among their early goals.

Of the 34 vendors surveyed, eight earned a C—respectable, but with room for improvement. They are CompuAdd Computer Corp., Compudyne Products, Everex Systems, NCR Corp., PC Brand, Samsung Electronics America, Tri-Star Computer Corp., and Unisys Corp. Except for CompuAdd, each had average ratings for reliability, repair experience, and technical support.

CompuAdd, which has closed its chain of 110 computer stores and is trying to emerge from Chapter 11, received a below-average rating for reliability, an average rating for satisfaction with repair experience—down from the last survey on both measures—and an above-average rating for satisfaction with technical support.

Readers' Report Card: PCs

PC Magazine,
January 11, 1994

PC Magazine,
July 1993

Grade

DESKTOP SYSTEMS

A	Dell Gateway Hewlett-Packard Swan ZEOS	Austin Compaq CompuAdd Dell Gateway Northgate Swan ZEOS
B	Apple AST Austin Compaq Digital IBM Micron Northgate	AST Digital Hewlett-Packard IBM NEC Tri-Star
C	CompuAdd Compudyne Everex NCR PC Brand Samsung Tri-Star Unisys	ALR Apple Compudyne DTK Epson Everex NCR PC Brand Samsung Texas Instruments
D	Acer DTK Epson NEC Wang Wyse	Acer Hyundai Memorex Telex Tandon Unisys Wang
E	ALR AT&T Hyundai Leading Edge Packard Bell Tandy ZDS	AT&T Leading Edge Packard Bell Tandy Wyse ZDS

PC Magazine,
January 11, 1994

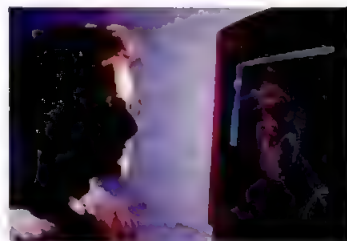
PC Magazine,
July 1993

Grade

LAPTOP SYSTEMS

A	Apple Compaq Gateway	Compaq Dell IBM Toshiba ZEOS
B	Dell Digital IBM Toshiba	Apple AST
C	CompuAdd Epson Everex GRID Sharp Tandy Texas Instruments ZEOS	CompuAdd Everex Gateway GRID Texas Instruments
D	AST Bondwell NEC	Bondwell Epson NEC Packard Bell Sharp Tandy
E	Compudyne ZDS	Compudyne ZDS

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Acer America Corp., DTK Computer, Epson America, NEC Technologies, Wang Laboratories, and Wyse Technology each received a combination of average and below-average scores on the three key measures, earning them each a D. For DTK, Epson, and NEC, this grade represents a drop from their previous standings, while it is an improvement for Wyse. Wyse moved into the average category for satisfaction with technical support. Over the past year, Wyse has hired several support technicians and has revamped its phone system and BBS.

The scores for DTK, Epson, and NEC have dropped over time. In previous surveys, NEC enjoyed above-average ratings for reliability and average ratings for technical support and repair experience; now, NEC has an average score for reliability and below-average scores for satisfaction with repair experience and technical support. DTK and Epson each received average ratings for all measures in past studies. This time around, Epson's score for reliability dropped to below the average, while DTK's scores for satisfaction with both repair experience and technical support dropped to below the average.

With below-average scores on each of our key measures, Advanced Logic Research, AT&T, Hyundai Electronics America, Leading Edge Products, Packard Bell Electronics, Tandy Corp., and Zenith Data Systems each earn an E—our lowest grade. For most—AT&T, Leading Edge, Packard Bell, Tandy, and ZDS—these grades represent continued membership in the lowest tier. All were rated among the worst in terms of how long broken systems remained unusable.

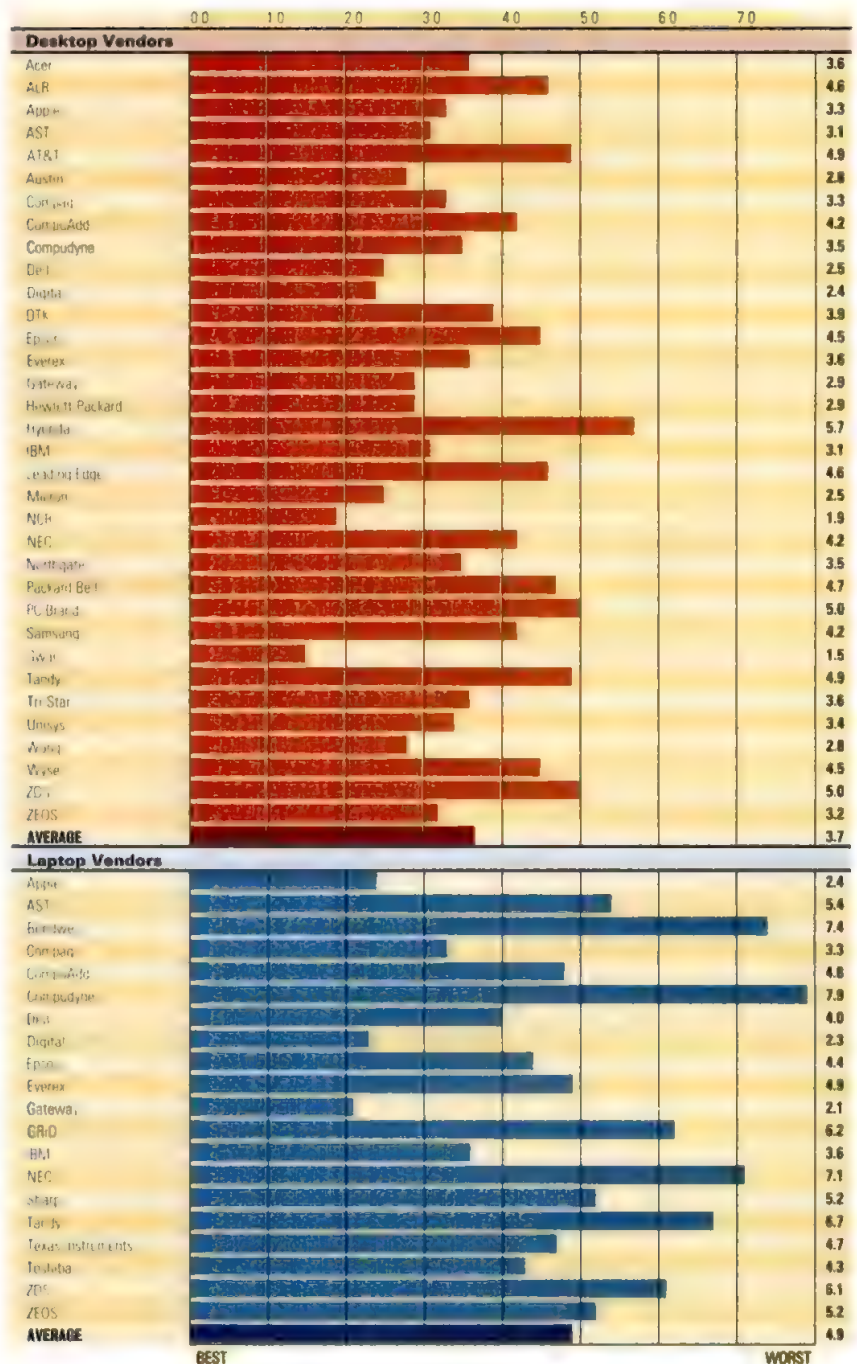
ALR has moved down two rungs to the bottom category. While the company received average scores across the board on the last survey, all its scores are now below the average. For Hyundai, the drop results from its scores for satisfaction with repair experience and technical support returning to below the average after a one-time showing at average.

It is interesting to look behind the numbers for the results of AT&T, Hyundai, Leading Edge, Tandy, and ZDS, each of which received their ratings for a disproportionate number of older and presumably less-reliable sys-

The Repair Record

In general, the average number of days a desktop or notebook PC is out of service directly corresponds to our readers' ratings of reliability and satisfaction with repair experience and technical support. Our Readers' Choice award recipients all enjoyed repair records that were better than the average. On the other hand, vendors near the bottom of our Readers' Report Card generally had poor repair records. Note that only those readers experiencing repairs or technical support problems responded to this question.

AVERAGE DAYS OUT OF SERVICE



How Readers Rated PC Vendors

Our survey asked readers to rate up to five PCs used in the past two years.

Readers rated vendors on a scale of 1 (worst) to 10 (best) in terms of overall reliability, satisfaction with repair experience, and satisfaction with technical support. We gave equal weight to all

vendors' scores when computing the overall average score for each measure. We used a standard t-test of means to identify significant differences between vendors' scores and the average. Deviations from the average are not always statistically significant; therefore, some vendors may show the same score but have different grades.

■ Significantly above average ■ Average ■ Significantly below average

	Number of responses	Overall reliability	Satisfaction with repair experience	Satisfaction with technical support	Future likelihood of buying from the vendor
Desktop Vendors					
Acer	241			0.7	
ALR	229	7.9	6.9	6.5	
Apple	597	8.1			6.5
AST	866	7.9			8.9
AT&T	256	7.7	6.9	6.4	6.6
Austin	120	8.1			7.9
Compaq	1,449	7.7		7.5	7.9
CompuAdd	442	8.9		7.5	8.8
CompuDyne	163				7.9
Dell	1,096	8.7	8.2	8.3	8.6
Digital	195			7.9	
DTK	454		7.2	6.8	
Epson	286	8.8			8.3
Everex	407				8.3
Gateway	2,093	8.8	8.5	8.8	7.8
Hewlett-Packard	349	8.8	8.1	7.9	7.8
Hyundai	149	7.8	6.9	6.2	8.2
IBM	3,059	7.8	7.7		7.7
Leading Edge	364	7.7	6.6	8.8	4.9
Micron	62	8.9		6.5	7.6
NCR	143				
NEC	333		7.1	6.8	
Northgate	332		8.3	8.3	6.8
Packard Bell	844	8.8	7.2	7.8	
PC Brand	147				
Samsung	87				8.2
Swan	85	8.8	8.8	8.8	7.9
Tandy	433	7.8	6.7	6.3	6.6
Tri-Star	76				7.9
Unisys	205				6.8
Wang	102	7.4			4.2
Wyse	123	7.8	6.6		8.5
ZDS	520	7.8	7.8	6.4	6.8
ZEOS	605	8.7	8.3	8.9	7.9
Average					
Laptop Vendors					
Apple	154	8.8	7.7	8.1	7.7
AST	190	7.7			
Bondwell	88	7.7		5.9	6.9
Compaq	705	8.3	7.8	7.9	7.8
CompuAdd	133				
CompuDyne	79	7.4	6.8	8.2	
Dell	305		7.5	8.1	7.3
Digital	50	8.8			
Epson	68				
Everex	78				8.8
Gateway	133	8.8	8.9	8.1	7.7
GRiD	86				8.8
IBM	361	8.8		7.8	8.7
NEC	201		6.5		6.8
Sharp	80				8.8
Tandy	119				8.8
Texas Instruments	168				7.7
Toshiba	886	8.1		7.8	7.9
ZDS	411	7.7	6.3	6.4	6.4
ZEOS	142				7.8
Average					

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tems. For these companies, 8086-, 8088-, and 286-based systems accounted for between 48 and 63 percent of their rated installed bases, compared with 22 percent for the average vendor. However, an informal look at how well they do with 386s and 486s shows only modest improvements.

LAPTOP LEADERS

Apple, Compaq, and Gateway each received above-average scores on the three key measures for portables, earning A grades. Of the 15 vendors that appear on both desktop and portables lists, only Gateway receives an A in both categories.

Apple's ascent into the top tier is a result of its scores for reliability and satisfaction with repair experience rising from average to above the average. Gateway, whose laptop ratings first appeared in our last survey, rockets to the head of the class with improved ratings on all three key measures, which were average last time. This is ironic in light of the fact that the Gateway Nomad notebooks are essentially the same as the TI

TravelMate 4000-series laptops, for which Texas Instruments receives an average reliability rating.

Dell, Digital, IBM, and Toshiba America Information Systems each earned a respectable B. However, all but Digital have slipped a notch, returning to positions held two surveys ago. Dell earned an average score for reliability and above-average scores for satisfaction with repair experience and technical support—the same combination of scores it received prior to the last survey. Dell has suffered lately on the laptop front, as the company recalled its SLi subnotebook series for potential overheating problems. Dell's lack of a 486-class laptop also has affected its competitiveness.

Both IBM and Toshiba received above-average scores for reliability and

satisfaction with technical support. Digital sells AST-made notebooks, but ranked two levels higher, because of its lone above-average rating on reliability compared to AST's below-average score.

Eight laptop vendors earned a grade of

C. CompuAdd, Epson, Everex, GRiD Systems Corp., Sharp Electronics Corp., Tandy, Texas Instruments, and ZEOS each received average ratings on all three key measures. For CompuAdd, Everex, GRiD, and Texas Instruments, this represents a repeat performance. For ZEOS,

the grade is a result of its score dropping on all measures. For Epson, Sharp, and Tandy, the grade reflects an improvement of readers' satisfaction with technical support.

With different combinations of average and below-average scores, AST,

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Bondwell Industrial Company, and NEC receive Ds. While NEC and Bondwell have been in this category before, AST drops from its grade of B on our last survey, which is a result of its reliability rating dropping from average to below the average; satisfaction with technical support and repair experience ratings returned to average after a one-time showing as above the average.

With below-average scores across all three measures, Compudyne and ZDS earn Es. As with desktops, here again ZDS has a disproportionate number of PCs with older chip types. An informal look at the scores shows some improvement for units with newer chip types, but not enough to yield the vendor a top rating.

Compudyne portables were out of service for an average of 7.9 days, down almost a full day from the last survey, but still far from acceptable. Gateway led this area with it taking just over two days to repair the company's notebooks. In addition, for 61 percent of the Compudyne laptops rated, readers reported needing

repairs on one or more components. In contrast, not more than half of the PCs manufactured by other vendors required component repairs.

TODAY...TOMORROW?

A critical measure of satisfaction is the likelihood that one would buy a new PC from the same vendor. While service and reliability certainly factor into this decision, a consumer's individual perception of the company also has an impact. While this rating is not factored into the Readers' Report Card, the results tend to reinforce the grades.

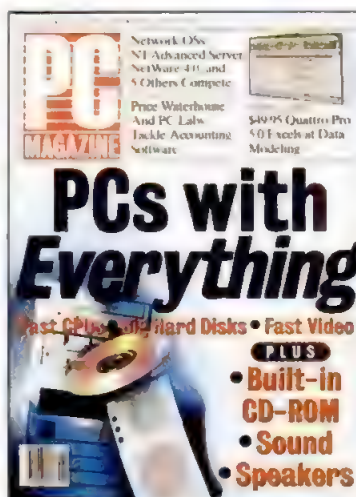
Generally, both desktop and portable vendors who earned As and most of those with Bs were thought of highly enough to receive above-average ratings on the future likelihood-to-buy measure. In the desktop category, IBM notably rose from below the average to average, showing that the public may now have a favorable impression of its massive restructuring.

On the desktop front, CompuAdd's results stand out: The company dropped

from above the average to below the average. Packard Bell fell to average in this measure. The company has recently merged with ZDS, and is revamping both its systems and the level of support given. The company has hired 100 new support technicians and can now ship key parts within 48 hours. But as Packard Bell's vice-president of product marketing Fred Kern says, "Improvement takes time; it's not an overnight affair."

Interestingly, three portable vendors—Dell, IBM, and Toshiba—who slipped a notch overall, remain in the top tier for future purchases. Other vendors who enjoy above-average scores on this critical measure are Texas Instruments and ZEOS, each of which earned a C. The scores for AST and Epson reflect their overall rankings—Epson's rating for this measure improved to average, while AST's dropped to average.

The PC market continues to change quickly and drastically. So much so that for many vendors improving reliability and support is a moving target. The best companies aim high and hope for the best.



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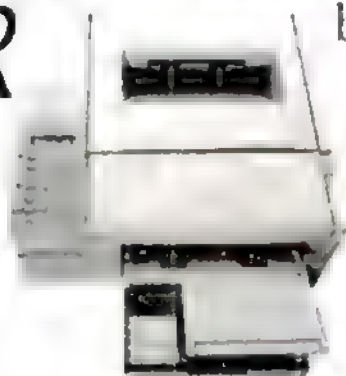
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PRINTERS:

Imprint of Satisfaction

by Rachel Derby Teitler



Printers and the way we use them change with the office landscape, as do our expectations and perceptions of reliability, repair service, and technical support.

Overall, readers responding to our Service & Reliability survey told us their printers were highly reliable. The average score for reliability across all vendors was 8.5. Market leader Hewlett-Packard Co. received the highest reliability rating (9.3), and even the low scorer, Tandy Corp., weighed in with a respectable 7.8. Clearly, printers have become one of the

more reliable devices we deal with every day. However, respondents were a bit less satisfied when something went wrong. Their experiences with repair service and technical support for their printers received average ratings of 7.5 and 7.3, respectively.

This is our second annual Printer Ser-

vice & Reliability survey. In taking our poll, we asked the same key questions as we did last year (see "Service and Reliability: Which Printers Do You Rate the Highest?", *PC Magazine*, November 23, 1992). Last year, the ratings (similar to these A-B-C-D-E scores) were derived from the three key measures—reliability, satisfaction with repair experience, and satisfaction with technical support—plus a fourth question regarding a user's future likelihood of buying a new printer from the same vendor.

Although the future likelihood of buying from the same vendor is an important consideration on which we will continue to survey readers, we did not count it when calculating grades this year because

HIGHLIGHTS

Service & Reliability: Printers

SERVICE AND RELIABILITY continue to be important factors in users' assessments of their printers. To learn about our readers' experiences in these areas, *PC Magazine* surveyed 7,500 subscribers during the early summer, asking them to rate their printers and vendors on three key measures: reliability, satisfaction with repair experience, and satisfaction with technical support. We also asked about future likelihood of buying a new printer from the same vendor and about performance issues. Sixteen printer vendors are represented in the survey findings.

READERS BELIEVE their printers to be highly reliable. On a scale of 1 (worst) to 10 (best), readers rated their printers 8.5 in reliability, on average. They were somewhat less satisfied with their repair experiences (7.5) and technical support (7.3). Epson and Hewlett-Packard received the top grade of A on overall service and reliability. No printer vendor received the lowest grade of E.

A PERSON'S FUTURE likelihood of buying from the same printer vendor often relates to the cost of the product, perceptions about the company's

future, or other things not directly related to service and reliability. Thus, this question was not considered when calculating vendors' overall grades.

NETWORKED PRINTERS generally received higher satisfaction ratings than nonnetworked printers on attributes such as speed, printing documents with multiple fonts, output quality, and noise level. Twenty-eight percent of respondents' printers were connected to a network. Nonnetworked printers achieved higher reliability ratings.

it may be based on other, less quantifiable considerations. Therefore, this year's vendor rankings should not be compared with last year's.

AT THE TOP: HP, EPSON

Hewlett-Packard and Epson America scored at the head of the class to earn an A on our Readers' Report Card and take the two Readers' Choice awards in the printer category this year. Both received above-average ratings on all three of the key measures of our survey, as they did last year. Hewlett-Packard goes a step further, however, with a score on each measure that is significantly higher than Epson's.

Digital Equipment Corp. and Panasonic Communications & Systems Co. fared well in our survey. Each received a B on our Readers' Report Card. Digital scored above the average in satisfaction with technical support.

Panasonic continues to enjoy an above-average rating for reliability. However, while users' ratings on satisfaction with technical support and repair experience have not changed numerically from last year, Panasonic's scores

on those measures relative to other vendors' scores are now considered average.

Eight vendors earned a grade of C. ALPS America, Apple Computer, Canon Computer Systems, Citizen America Corp., Okidata, QMS, Star Micronics America, and Texas Instruments each received average ratings on the three key measures. Consistency seems to be the hallmark of this group. With QMS as the key exception, none of the vendors' scores on these key measures changed significantly from last year's survey. On satisfaction with technical support, readers gave QMS a much-improved rating of average, compared with the below-average score QMS received last year.

Lexmark International, NEC Tech-

Readers' Report Card: Printers

Grade	
A	Epson Hewlett-Packard
B	Digital Panasonic
C	ALPS Apple Canon Citizen America Okidata QMS Star Micronics Texas Instruments
D	Lexmark NEC Tandy Toshiba

nologies, Tandy, and Toshiba America Information Systems received a D with a combination of average and below-average scores in this year's ratings.

• Lexmark printers received below-average ratings on reliability, down from the average rating the company received for reliability last year. And Lexmark's rating on satisfaction with

technical support also dropped down to average.

• NEC, just as it did last year, received a below-average rating for satisfaction with technical support. And this year, NEC users' satisfaction with repair experience also dipped to that level.

• Tandy users' satisfaction with technical support improved enough to push it into the average category. Users rated the



READERS' CHOICE

- Epson
- Hewlett-Packard

Two of the three top-rated printer manufacturers on last year's survey—Epson and Hewlett-Packard—are at the head of their class once again among *PC Magazine* readers in the 1993 Printer Service & Reliability survey.

These two vendors both received grades of A on our Readers' Report Card to capture Readers' Choice awards. Readers' Choice award winners are vendors that our readers rated significantly above the average on each of the three key measures of our survey: overall reliability, satisfaction with repair experience, and satisfaction with technical support. Of the survey responses we received from users of Hewlett-Packard's printers, 77 percent came from those who used its laser

printers. In comparison, 90 percent of the Epson users who responded reported using the company's dot matrix printers.

Digital and Panasonic both received grades of B on our Readers' Report Card. Each of these companies earned a combination of average and above-average scores on the three key measures of our survey. Panasonic was rated above the average on printer reliability and average on satisfaction with repair experience and technical

support by our survey respondents. Digital users rated reliability and satisfaction with repair experience average and technical support above the average.

The list of companies that received grades of C from our readers includes ALPS, Apple, Canon, Citizen America, Okidata, QMS, Star Micronics, and Texas Instruments. Each of these vendors received average ratings on all of the three key measures.

Lexmark, NEC, Tandy, and Toshiba all received combinations of average and below-average ratings on the three key measures to earn grades of D. No vendor received only below-average ratings, which would have resulted in the lowest grade of E.

Of the 8,197 total printers for which we received ratings on our Printer Service & Reliability Survey, two-thirds were manufactured by Epson, Hewlett-Packard, and Panasonic.

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company below the average on reliability, however. That's a drop from last year's rating.

• Toshiba's reliability rating improved to average, although satisfaction with technical support took a dip from average to below the average.

FUTURE LIKELIHOOD OF BUYING

When we asked whether the subscriber would buy another printer from the same company, our survey participants rated six vendors above the average: the Readers' Choice winners Hewlett-Packard and Epson, plus Canon, Okidata, Panasonic, and QMS. Five were rated average in this category of satisfaction with a manufacturer of printers. Five manufacturers with ratings that fell below the average are ALPS, Digital,

NEC, Tandy, and Toshiba.

For Toshiba, there's good reason why readers say that they are less likely to buy again: Toshiba is no longer in the dot matrix printer market. The company now markets network-compatible laser printers.

LOOKING AHEAD

Based on the results of this survey, we believe users are generally satisfied with their printers. It is the area of support where the improvement needs to take place.

As we look forward to future developments in this fast-growing marketplace, we will also keep an eye on the vendors and how their service and support policies develop to keep pace with this competitive market.

■ How Readers Rated Printer Vendors

Our survey asked readers to rate up to five printers used in the past two years. This chart shows the ratings for each vendor about which we received at least 50 responses. The vendors are rated on three key measures: reliability, satisfaction with repair experience, and satisfaction with technical support. The chart also shows how the readers rated their likelihood of buying new printers from the same vendors. This measure was excluded when we calculated the overall grades.

Readers rated the vendors on a scale of 1 (worst) to 10 (best). The ratings shown

here are derived from the 3,736 completed surveys we received out of a total of 7,500 surveys we mailed. We have included the number of responses we received for each vendor. In computing the overall average score for each key measure, we gave equal weight to all vendors' scores. We employed a standard t-test of means to determine whether there was a significant difference between each vendor's score and the overall average. Deviations from the average are not always statistically significant; thus, some vendors may show the same score but have different grades.

■ Significantly above average ■ Average ■ Significantly below average

	Number of responses	Overall Reliability	Satisfaction with repair experience	Satisfaction with technical support	Future likelihood of buying from the same vendor
ALPS	66	5.8	6.8	6.8	5.0
Apple	158	6.8	6.8	6.8	6.8
Canon	157	6.8	6.8	6.8	7.9
Citizen America	163	6.8	6.8	6.8	6.8
Digital	63	5.8	6.8	6.8	5.8
Epson	1,158	8.8	7.8	7.8	7.8
Hewlett-Packard	3,144	8.8	8.8	8.8	8.2
Lexmark	314	6.8	6.8	6.8	6.8
NEC	208	5.8	6.8	6.8	6.8
Okidata	477	6.8	6.8	6.8	7.4
Panasonic	1,130	8.8	6.8	6.8	7.4
QMS	104	6.8	6.8	6.8	7.4
Star Micronics	235	6.8	6.8	6.8	6.8
Tandy	108	7.8	6.8	6.8	5.1
Texas Instruments	70	6.8	6.8	6.8	6.8
Toshiba	63	5.8	6.8	6.8	5.8
Average		6.8	6.8	6.8	6.8

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MONITORS:

Monitoring Satisfaction

by *Tin Albano and Rachel Derby Teitler*



In May, 1993, questionnaires were sent to a random sample of 7,500 *PC Magazine* subscribers, asking them to describe up to five monitors they've used in the past two years. The bottom line of the survey is that most readers found the monitors they've used in the past two years to be very reliable.

The average score for reliability of monitors across the entire field of vendors was quite high at 8.7, with scores ranging from a low of 8.1 for Acer America Corp. to a high of 9.7 for Nanao USA Corp.

Indicative of the trend we have seen in other areas, our readers were not as satisfied with repair experience and technical support, however, where overall manufacturers' averages dropped to 7.5 and 7.4, respectively.

SETTING THE PACE

Both MAG InnoVision and NEC Technologies set the pace and were given As on our Readers' Report Card by receiving above-average ratings on each of the three key measures of our survey, overall reliability, satisfaction with repair service, and satisfaction with technical support. This earned both of them our Readers' Choice award.

Mitsubishi Electronics America, Nanao, Sony Electronics, and ViewSonic fared well, each receiving a B on our Readers' Report Card. Each had above-average ratings on reliability, with Nanao enjoying a reliability score significantly higher than all other vendors including Readers' Choice recipients MAG and

HIGHLIGHTS

Service & Reliability: Monitors

SERVICE AND RELIABILITY of a monitor is becoming more important to users in their assessments of whether they have been happy with their monitors. To learn about our readers' experiences in these areas, *PC Magazine* surveyed 7,500 subscribers, asking them to rate their monitors and vendors on three key measures: reliability, satisfaction with repair experience, and satisfaction with technical support. We also asked about the future likelihood of their buying a new monitor from the same vendor. Twenty-three monitor vendors are represented in the survey findings.

READERS FOUND their monitors, in general, to be highly reliable. On a scale of 1 (worst) to 10 (best), our survey participants rated their monitors 8.7 in reliability, on the average. They were somewhat less satisfied with their repair experiences (7.5) and with manufacturers' technical support (7.4).

THE HIGHEST GRADES were given to MAG and NEC. Each of these vendors received the top overall grade of A on our Readers' Report Card.

THE FUTURE LIKELIHOOD of buying

from the same monitor manufacturer often relates to the cost of the product or to other factors that are not directly related to service and reliability. Thus, users' likelihood-to-buy responses were not considered when we calculated each of the monitor vendors' overall grades.

MOST MONITORS HAD 13- TO 15-inch-diagonal screens. More than half of the monitors' screens had maximum resolutions of 800-by-600 or higher, and nearly one-third of the monitors had resolutions of 1,024-by-768 or higher.



READERS' CHOICE

- MAG
- NEC

Recipients of our Readers' Choice award are vendors that our readers rated as being above the average on all three key measures of our 1993 Service and Reliability survey: overall reliability, satisfaction with repair experience, and satisfaction with technical support.

Readers were also queried as to whether or not they would purchase monitors from the same vendors in the future. However, readers' responses to this question were not factored into each vendor's final rankings. The question is subjective, and responses could therefore be based on issues other than service and reliability, such as a respondent's perception of a vendor's financial stability.

This year, the winners of our Readers' Choice award in the monitor cate-

gory are MAG and NEC. Both of these vendors received above-average ratings on all three key measures of our survey, and therefore they receive a grade of A on our Readers' Report Card.

FOUR WHO COULD

Four other vendors fared well in this survey (Mitsubishi, Nanao, Sony, and ViewSonic), receiving average and above-average scores on all three key measures, and all earning grades of B

on our Readers' Report Card. Nanao enjoyed a reliability score significantly higher than that of any other vendor, including MAG and NEC. Nanao also received an above-average score for satisfaction with repair experience, while Sony had an above-average rating for satisfaction with technical support.

Thirteen of the vendors included—AST, Compaq, CTX, Hyundai, IBM, Magnavox, Packard Bell, Panasonic, Princeton Graphic Systems (which has gone out of business), Relisys, Samtron, Tandy, and Tatung—received average ratings on each one of the three key measures, to earn a grade of C from our readers.

Four vendors—Acer, GoldStar, Samsung, and ZDS—received a combination of below-average and average scores for a grade of D. No vendor got a grade of E, merited by receiving only below-average ratings.

NEC. Nanao also received an above-average score for satisfaction with repair experience, while Sony had an above-average rating for satisfaction with technical support.

IN NEED OF IMPROVEMENT

Of the 24 monitor vendors that were surveyed, 13 rated average and received a grade of C on our Reader's Report Card. Each of the vendors—AST Research, Compaq Computer Corp., CTX International, Hyundai Electronics America, IBM Personal Computer Co., Magnavox, Packard Bell Electronics, Panasonic Communications & Systems Co., Princeton Graphic Systems (which has gone out of business), Relisys, Samtron Displays, Tandy Corp., and Tatung Co. of America—received average ratings on each of the three key measures of the survey.

Four vendors received Ds—Acer, GoldStar Technology, Samsung Electronics America, and Zenith Data Systems—for a combination of below average and average scores on the three key measures. Acer, GoldStar, and ZDS received below average ratings for reliabil-

ity, with GoldStar receiving a below-average rating for satisfaction with repair experience as well. Samsung's D grade is a result of a below-average score for satisfaction with technical support.

In a break with the other categories of our Service & Reliability survey, none of the vendors deserved an E.

WOULD YOU BUY IN THE FUTURE?

Perhaps the most critical indicator of users' satisfaction with vendors is the degree to which the customer would consider purchasing a new monitor from the same vendor. Clearly this decision is based on a wide variety of issues, including, but not limited to, service and support.

Users' scores on these measures

tended to parallel ratings on the three key measures, with all of the vendors who earned As and Bs enjoying above-average scores on the future likelihood to buy question. Three out of the four vendors who received Ds (GoldStar, Samsung, and ZDS) received below-average scores on this measure; Acer's score was average. Of the thirteen vendors that got C's, none received above-average likelihood-to-buy ratings.

IMPORTANT CHARACTERISTICS

In addition to the four measurements discussed above, readers indicated their level of satisfaction with the following seven monitor-specific issues: size of the monitor for text, size of the monitor for graph-

Readers' Report Card: Monitors

A	MAG NEC
B	Mitsubishi Nanao Sony ViewSonic
C	AST Compaq CTX Hyundai IBM Magnavox Packard Bell Panasonic Princeton Graphic Systems Relisys Samtron Tandy Tatung
D	Acer GoldStar Samsung ZDS

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CIRCLE 318 ON READER SERVICE CARD

ics/Microsoft Windows, image clarity, level of flicker, level of glare, placement of monitor controls, and ability to adjust image using monitor controls. The results of the Service & Reliability survey show that our readers' satisfaction for these characteristics seemed to parallel their likelihood of buying a new monitor from the same vendor.

Each of the vendors in our survey that received above-average scores for likelihood to buy also received above-average scores on several of the monitor-specific characteristics, and in no

*Readers' satisfaction
with their units paralleled
their likelihood of
buying a new monitor
from the same
vendor.*

case did a vendor earn below-average scores on these characteristics. For instance, Nanao and NEC received above-average ratings for all seven of the specific characteristics. MAG was given an above-average rating for all characteristics except size of monitor for graphics/Windows use, where it received an average score.

Of those vendors that received average ratings for future likelihood to buy from the same vendor, most received average ratings for the monitor characteristics examined, but there were some exceptions.

On the one hand, CTX and Magnavox received above-average ratings on placement of monitor controls and ability to adjust image using monitor controls. On the other hand, Samtron and Relisys received below-average ratings, the former for placement of monitor controls and the latter for ability to adjust image using monitor controls.

Vendors whose scores were below the average for likelihood to buy received a combination of below-average and average scores on these measures. The one positive standout is the above-average

score that Zenith Data Systems received for level of glare. This may be primarily due to ZDS's outstanding Flat-Tension Monitor technology.

HOW BIG IS BIG?

Respondents to our Service & Reliability questionnaire were also asked about the screen size of their monitor and its maximum resolution. The results are enlight-

ening. Regarding screen size, we found that for all monitors rated, 87 percent of the readers who responded had 13- to 15-inch diagonal screens, 8 percent had 16- to 17-inch screens, and 3 percent had screens that were 19 inches on the diagonal or greater (referred to below as standard, medium, and large, respectively). Of the large monitors rated (19 inches diagonal or greater), 43 percent were manufac-

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tured by NEC and Mitsubishi, with NEC holding a slight edge.

Questioning respondents on the maximum resolution of their monitor, we found that 13 percent were text only, CGA or EGA; 28 percent were VGA (640-by-480); 23 percent were super VGA (800-by-600); and 32 percent operated at 1,024-by-768 resolutions or higher. Among the monitors that did support resolutions of 1,024-by-768 or higher, nearly one-quarter were medium or large in size.

In examining the monitors without respect to manufacturer, we also found a strong correlation between respondents' overall satisfaction and their future likelihood of purchasing another monitor

*The above-average
score that Zenith Data
Systems units received
for glare is probably
a result of ZDS'
Flat-Tension monitor
technology.*

from the same vendor, and the size and resolution of their monitor. Regarding overall reliability, monitors that garnered scores that were significantly above the average on this measure were standard- or medium-sized, with maximum resolutions of 1,024-by-768.

Displays that rated significantly below the average on this measure were of older designs, primarily the text only/CGA/EGA variety and were standard size.

In terms of future likelihood of purchase from the same vendor, the participants in our survey once again tended to look more favorably on higher-resolution and larger-size monitors. Monitors that had maximum resolutions of 1,024-by-768 or higher enjoy above-average scores regardless of their size (small, medium, or large). And both medium-size VGA and Super VGA monitors also garnered above-average scores in this measure.

■ How Readers Rated Monitor Vendors

Our survey asked readers to rate up to five monitors used in the past two years. The chart shows vendor ratings on three key measures: reliability, satisfaction with repair experience, and satisfaction with technical support. Also shown is how readers rated their likelihood of buying new monitors from the same vendors. This measure was excluded when we calculated overall grades.

Vendors were rated on a scale of 1 (worst) to 10 (best). In computing the overall average for each measure, we gave equal weight to all vendors' ratings. We used a standard t-test of means to identify significant differences between vendors' scores and the average. Deviations from the average are not always statistically significant; thus, some vendors may show the same score but have different grades.

■ Significantly above average ■ Average ■ Significantly below average

	Number of responses	Overall reliability	Satisfaction with repair experience	Satisfaction with technical support	Future likelihood of buying from the vendor
Company					
Acer	66	8.1			
AST	96				
Compaq	219				
CTX	255				
GoldStar	210	8.3	8.4		6.4
Hyundai	80				6.6
IBM	610				6.4
MAG	161	9.1	8.6	8.3	8.4
Magnavox	156				
Mitsubishi	158	9.0			7.9
Nanao	70	9.2	9.1		9.3
NEC	890	9.3	8.4	8.3	8.7
Packard Bell	296				
Panasonic	101				
Princeton Graphic Systems	62				6.1
Relisys	58				
Samsung	311			6.8	6.7
Semtron	70				
Sony	177	9.2		8.2	8.3
Tandy	116				8.9
Tatung	63				
ViewSonic	201	9.0			8.8
ZDS	201	8.4			6.6
Average		8.8	8.8	8.8	8.8
Monitor type					
Text-only/CGA/EGA		6.4	7.2	7.0	6.2
VGA (640 x 480)		8.2	7.2		6.6
Super VGA (800 x 600)		8.9			7.6
1,024 x 768 or higher		9.1	8.3	8.2	8.1
Average		8.8	8.8	8.8	8.8

On our questionnaire, we also asked our respondents to tell us whether they use their monitor at its maximum resolution when they were operating in the Windows environment.

RESOLUTION TO THE MAX

Surprisingly, for approximately one-fifth of all the monitors that were rated, readers did not know whether the monitor was operated at its maximum resolution, and for almost as many units, we did not receive an answer to this question. For those monitors for which we did receive

a yes or no response, nearly six out of ten are used at maximum resolution under Windows.

We found that the majority of our readers were happy with their monitors regardless of size or resolution.

Not surprisingly, as monitors become more sophisticated and users demand larger graphics real-estate space, they become more concerned with these seven specific performance issues and getting the most from their products. Monitor vendors will have to provide the utmost in comprehensive service and support. □

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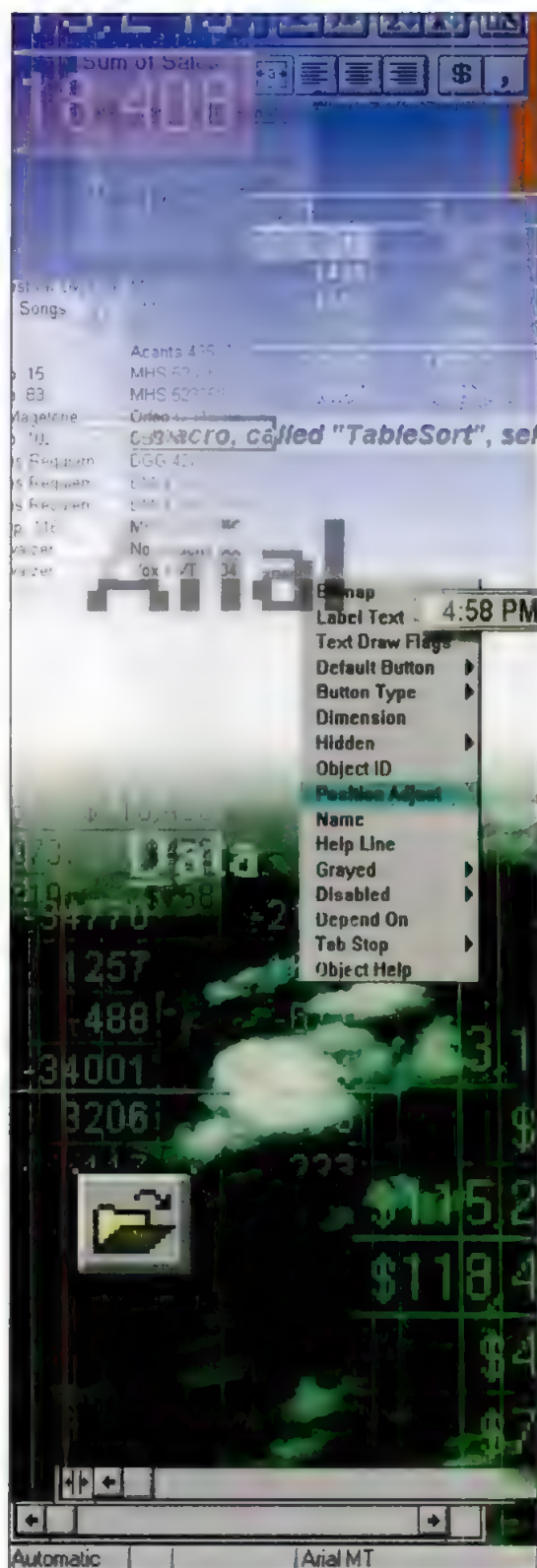
Less Is More

Fewer in number but grander in features, the spreadsheet products *PC Magazine* reviews in this annual feature are industry survivors.

by Craig Stinson

In this more-or-less-annual *PC Magazine* survey of spreadsheet software, we review five products from—count 'em—two vendors. That should tell you something about what's going on in the spreadsheet market.

In truth, the shakeout hasn't been quite as extreme as those numbers suggest. Microsoft Excel for Windows would also have been reviewed in the following pages, alongside Borland's Quattro Pro and Lotus's 1-2-3 spreadsheets, were it not for the notorious difficulties of finishing any large-scale Windows programming project on time (for details, see the sidebar "Waiting in the Wings: Excel 5.0"). Meanwhile, Lucid Corp.'s first-ever Lucid 3-D for Windows was shipping in time for this review, but several bugs prohibited it from running our performance tests. (One other product not included here is Informix Software's Wingz, Version 2.0.)



Moreover, the dwindling of last year's eight candidates to this year's five is reflective less of mortal vendor combat than of the approaching *fin-du-OS*. There will no doubt be champions of character mode well into the twenty-first century, but the vendors' R&D allocations will no longer encourage them. Three DOS spreadsheets (Computer Associates' CA-SuperCalc 5.5, FormalSoft's InstaCalc, and Lucid 3-D) have not been revised since our November 1992 review, and apparently will be revised no more.

Lotus 1-2-3, Release 2.4 (which ran on any x86 machine), will not be revised either. Lotus has said its next version of 1-2-3 for DOS will merge Releases 2.x and 3.x which, considering that 3.x uses extended memory and requires a 286 processor or better, seems an artful way of saying so long to the world's best-selling

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application, the product to which Lotus (along with countless third parties) has owed its existence. Computer Associates and Lucid Corp. say they're "waiting and seeing" what the market will demand before committing to new DOS versions of CA-SuperCalc and Lucid 3-D. (Computer Associates is working on a Windows version of CA-SuperCalc, now scheduled for shipment in the first quarter of 1994.) Borland, too, is playing wait-and-see; its latest update to Quattro Pro for DOS is a small-scale tune-up designed

to make the product look more like its massive Windows sibling.

INTO THE FUTURE

Meanwhile, great developments continue to occur on the Windows side of the slope. One thing you'll certainly notice if you glance at the photographs accompanying these reviews is a certain, shall we say, commonality of design. The tabbed-notebook approach to three-dimensional spreadsheeting, first introduced last year by Borland's Quattro Pro for Windows, Version 1.0, has carried the day. 1-2-3 for Windows, Excel 5.0, Lucid 3-D for Windows, and Quattro Pro for DOS, Version 5.0, have all adopted it, and so will the next DOS spreadsheet from Lotus.

The notebook idea makes three-dimensionality usable. The page tabs let you assign descriptive names to each

HIGHLIGHTS

Spreadsheets

EXPECT FEWER CHOICES in the future. This *PC Magazine* roundup of newly released and upgraded spreadsheets surveys the products of only two vendors: Borland International and Lotus Development Corp. No, Microsoft hasn't gone out of the spreadsheet business, but it didn't deliver its revision of Microsoft Excel for Windows in time for this story. Lucid Corp. suffered a similar fate with its new Windows product. That's it, folks; these are the players now.

THE NOTEBOOK METAPHOR, pioneered by Borland in Version 1.0 of Quattro Pro for Windows, has won the informal industry accolade of universal imitation. Last year's innovation has become this year's standard, as all the major Windows spreadsheets currently offer three-dimensionality in the form of easy-to-use tabbed notebook pages. Soon, both major DOS spreadsheets will have this feature.

EASE OF USE continues to be a catchphrase among spreadsheet vendors. All major players now offer some

form of automatic summing, label/value filling, and formatting (all pioneered by Microsoft in Excel for Windows, Version 4.0). Also, automated helpers (Excel's wizards, Quattro Pro's experts) and teachers (Excel's Tip Wizards, Quattro Pro's Interactive Tutors) are getting smarter and better.

EXAMINE YOUR DATA from all sides with Excel 5.0's PivotTable Wizard and Quattro Pro for Windows 5.0's Data Modeling Desktop, both of which provide some of the data-manipulation capabilities found in the multidimensional CA-Compete! and Lotus Improv for Windows.

ACCESS TO "DATABASE" DATA is increasingly important as spreadsheets become front ends for analyzing and modeling the kinds of information commonly stored in large corporate databases. Microsoft will be replacing bundled Q+E with a home-grown applet called Microsoft Query—an outgrowth of Microsoft Access. Borland has strengthened its query

engine, Database Desktop, and Lotus Development has added a nifty query tool to Lotus 1-2-3 for Windows, Release 4.01, to complement the DataLens data access software that has been part of 1-2-3 releases since Release 3.0 for DOS.

WORKGROUP FEATURES are also rapidly becoming standard in the top-tier spreadsheet products. Excel introduced mail enablement, and Lotus improved it by tapping into the power of Lotus Notes. The Version Manager in 1-2-3, Release 4.01, allows workgroups to track multiple versions of a worksheet by multiple authors and create multiple scenarios using elements of different versions. New to Release 4.01 is Notes/FX (field exchange), which allows field "objects" to be shared across the entire Lotus Windows product line. Borland's Workgroup Desktop uses OBEX (object exchange) technology to "publish" Quattro notebooks (or parts thereof) across LANs, MCI Mail, and other communications facilities.



worksheet in your file (names that can be incorporated into formula references to enhance documentation of your model) and provide an easy way to move between pages. Except in the case of 1-2-3 for Windows, these notebook tabs allow you to rearrange a set of worksheets as simply and naturally as you would rearrange blocks of data on a single sheet.

EASY COMPLEXITY

Making these increasingly complex and comprehensive analytical instruments easier to learn and use continues to be a major theme in the development of spreadsheet software. Quattro Pro for Windows now comes with a set of "interactive tutors" that guide you through the learning process while you work with your own data. And to help you figure out just what all those buttons and "objects" in Quattro Pro for Windows are for, Borland offers a form of balloon help—similar to that provided by the Macintosh's System 7 but far less obtrusive.

Displaying the balloon in Quattro Pro for Windows requires a Ctrl key/right-click combination. Excel 5.0 offers a similar but more automated form of aid: If you leave your mouse on any toolbar icon for approximately 1.5 seconds, a simple description of the icon drops down from the bar. As soon as you click or move on, the "tool tip" goes away.

Excel for years has offered more keyboard and mouse shortcuts than most users could ever master. A list of the keyboard shortcuts alone filled 30 pages in the Excel 4.0 manual. To make those shortcuts (and other techniques) easier to learn, Excel 5.0 will include a Tip Wizard. The wizard's light-bulb changes from gray to yellow whenever you take a roundabout path for which a shortcut exists. You can click the bulb to read the wizard's tip, you can ignore it, or you can send it away for good. The wizard keeps track of your habits, however. If you continually ignore a piece of advice, it will quit offering that particular tip.

FUNCTIONAL AIDS

Constructing formulas in all three major Windows spreadsheets should be easier this year than last, thanks to new "function help" features. All three programs

EDITORS' CHOICE

• Quattro Pro for Windows, Version 5.0, Workgroup Edition

Perhaps the most amazing thing about Version 5.0 of Quattro Pro for Windows, Workgroup Edition, is that the Quattro Pro development team created it in less than a year's time. In the process, they eliminated most of the weaknesses of Version 1.0 (its predecessor) and

added lots of impressive new technology throughout the program.

Quattro Pro for Windows' function library, for example, has more than tripled in size with the addition of sophisticated engineering, financial, statistical, and time/date functions. Support for array formulas, also new, enhances processing efficiency and clarifies modeling logic. Quattro Pro for Windows' charting capabilities have also gained some serious muscle. Complementing the package's 13 new chart types is a set of analytical graphing tools that let you plot moving averages, generate regression lines, and aggregate data graphically without altering the numerical values in the spreadsheet.

Modeling and manipulation of flat-file data is the job of Quattro Pro for Windows' new Data Modeling Desktop add-in. With it, you can freely slice and dice your data by dragging row or column headings to new locations. Quattro Pro for Windows' Workgroup Desktop is an interface for a publish-and-subscribe system of sharing Quattro Pro notebooks, or parts thereof. The engine, which utilizes Borland International's OBEX (Object Exchange) technology, is built in and does not require the purchase or maintenance of additional software. We have by no means exhausted the list of new stuff, but you should have the general idea by now: This version is a powerful, feature-rich spreadsheet product.

The clear caveat with respect to Quattro Pro for Windows is its lack of speed. It turned in less-than-impressive numbers on just about all of our performance tests. Those with 4MB machines

probably won't want to use Quattro Pro for Windows. As RAM increases (we tested with 8MB), so does the package's speed.

An honorable mention goes to Lotus 1-2-3 for Windows, Release 4.01, clearly the most improved product in our roundup. When combined with Lotus Notes, it offers the most sophisticated workgroup capabilities around. Even without Notes, 1-2-3 for Windows' Version Manager—with its ability to track individual contributions to multi-user spreadsheets and turn them into multiple scenarios—is the most powerful feature of its kind.

Lotus 1-2-3 for Windows is also a good bet for those needing top-flight database querying and extracting features. DataLens, in combination with 1-2-3 for Windows' new query tool, outclasses the competition in this area. Superior performance and the convenience of in-cell editing are further reasons to recommend 1-2-3 for Windows. Moreover, the product is the clear choice for users needing full 1-2-3 macro compatibility under Windows.

And while we were unable to review Microsoft Excel for Windows, Version 5.0, for this story, what we did see of the prereleased version made it clear that Microsoft will continue to be a strong player in this market. Readers can look for three dimensionality in the vein of Quattro Pro for Windows, as well as for enhanced database management features. This version of Excel will also be the first to offer Microsoft Visual Basic, Applications Edition, as its macro language. The original Excel macro language will still be supported.

now relieve you of the need to remember a function's required and optional arguments. 1-2-3 for Windows and Excel are a little more generous with their help than Quattro Pro for Windows; their function helpers include text describing the purpose of each function.

Next to the "@function selector" in the upper-left corner of the 1-2-3 for Windows screen, you'll find a handy navigator icon that lets you move directly to any named range in the current file. Microsoft imitates this idea and takes it a step further: In Excel 5.0, you can also use the feature to name the current range, much as you might define a new style by typing a name into a drop-down list. Borland also has made it easier to name cells and ranges in Quattro Pro for Windows. A particularly valuable new feature now automatically assigns intersection-based names to cells according to their column and row headings, making it comparable to Excel in this respect.

The time-honored practice of editing worksheet data on the formula bar may soon become a thing of the past. 1-2-3 for Windows, Version 4.01, and Excel 5.0

both offer in-cell editing, which allows you to make changes to data directly on the worksheet. (For users more comfortable with the old method, Excel allows the user to toggle this feature on and off.)

QUERY-WEARY NO MORE

But the biggest and most welcome usability enhancements have been made on the database front. In 1-2-3 for Windows 4.01, Lotus has finally modernized its approach to setting up queries and extracts. Instead of setting criteria ranges on the worksheet, you can now use a straightforward dialog box to express your query. The dialog box presents the names of your fields, lets you choose from the actual values in your database range, and diagrams your query as you build it. Equally important, it lets you name and save the query for easy reuse.

Not to be outdone, Excel 5.0 also offers a new set of data management functions, allowing you to filter your data to show selected records only, add subtotals and grand totals, and sort records by choosing field names from drop-down lists. Excel automatically excludes field

headings from the sorting, and it also lets you create your own custom sort orders.

In the graphing department, look for new chart types, better analytical tools, and easier editing techniques. Excel 5.0 has added donut charts—pies that accommodate multiple data series—to its chart repertoire. Borland has ported over most of the analytical graphing features that were introduced a couple of years ago in Quattro Pro for DOS. These features make it easy to plot moving averages, to plot simple extrapolations and interpolations, and to plot forecast lines that incorporate exponential smoothing. Another handy set of commands computes and plots time-series aggregations (for example, monthly details can be translated into quarterly summaries). Microsoft has also beefed up the analytical prowess of its chart module, adding trend lines, error bars, and extrapolations to its command set.

Both Excel 5.0 and 1-2-3 for Windows now offer in-place chart editing. This feature lets you modify your graphs directly on the worksheet, where you can see all the surrounding context. Excel's chart-

Suitability to Task: Spreadsheets

In developing this year's Suitability to Task categories, we began with the topics in last year's roundup and made some changes. We rolled consolidation and linking into analysis and model building and introduced one new category (workgroup support). To make sure each package was evaluated as thoroughly as possible, we added many new subtasks within each task. Moreover, we now give separate ratings for power and ease.

In **analysis and model building**, we look at a program's ability to accept and manipulate data. We look at features such as the data entry tools, function library, and user-defined functions. We also look at range naming, annotation, spreadsheet auditing, goal seeking, and scenario management. Additionally, we examine the database tools for querying and manipulating both internal and external data, tools for organizing and consolidating data, and various table types such as frequency, sensitivity, and regression.

To evaluate a program's **charting**, we look at its

SUITABILITY TO TASK		
Product Name		
	POWER	EASE
Analysis and model building	Poor	Excellent
Charting	Fair	Good
Worksheet presentation	Good	Fair
Interoperability	Excellent	Poor
Applications development	Excellent	Poor
Workgroup support	N/A	N/A

N/A—Not applicable: The product does not perform this task.

analytical charting capabilities, as well as its ability to enhance a chart to make data easier to understand. We look at the number and quality of chart formats, the program's ability to automate simple charting tasks, and customization options such as titles, notes, multiple typefaces, objects, colors, and shading.

For **worksheet presentation**, we evaluate the ease and power with which a program allows users to turn worksheets into boardroom-quality documents for reading both on-screen and on paper. Top scores go to programs that support consistency with named styles,

offer an accurate print previewer, and include a broad range of font, shading, ruling, and color options.

Interoperability rates a program's ability to work with other spreadsheet file and macro formats, with emphasis on Lotus 1-2-3 compatibility. We also test a program's ability to integrate with nonspreadsheet applications, especially those from the same vendor. We look at a program's database access and query tools and its handling of text files.

Applications development examines the extent and flexibility of a spreadsheet package's macro language and its ability to produce screens, menus, icons, error handling, and help. We also look at debugging services and interfaces with other programming languages.

Workgroup support is the new category this year. We evaluate each program's ability to let you share data with other users, and the wealth and quality of transports that are used. Furthermore, we look at the scenario-management capabilities of each product within the context of a workgroup and examine how readily you can share part or all of a spreadsheet, track modifications, and integrate changes. Lotus 1-2-3 for DOS, Lotus 1-2-3 for OS/2, and Quattro Pro for DOS offer no workgroup support.

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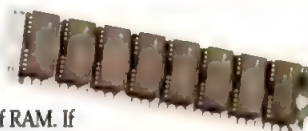
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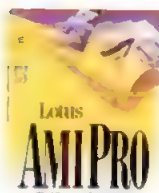
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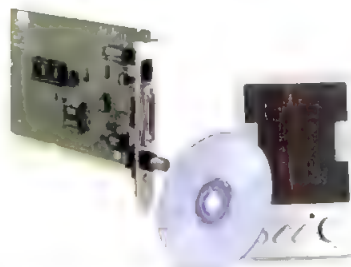
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editing features have been simplified in some other ways as well. The procedures for adding and manipulating text annotations have become much more intuitive, for example, and you can now add new data to a chart simply by dragging worksheet cells to the chart object.

EXPERT ANALYSIS

To keep pace with the Analysis Toolpak that Microsoft introduced in Excel 4.0 in 1992, Borland has added an Analysis Expert to Quattro Pro for Windows. The new expert provides enhanced statistical functionality (advanced regression analysis, correlation, covariance, ANOVA, F-tests, t-tests, and z-tests, rank-and-percentile analysis, and more), calculates nonuniform sets of random numbers, does moving averages, and so on. And both Quattro Pro for Windows and 1-2-3 for Windows have been given a massive infusion of new worksheet functions. In terms of sheer plenitude, Quattro Pro for Windows (Version 5.0) is way out in front, with 373 functions. But Excel 5.0 remains the only major spreadsheet that lets you create your own functions using the program's native macro language.

When it comes to the management and modeling of alternative scenarios, however, the way-coolest spreadsheet is now 1-2-3 for Windows. Lotus's Version Manager, introduced with the 4.x line of 1-2-3 for Windows, lets you enter alternative sets of values into ranges and then gather groups of alternative ranges into named scenarios. The program handles input from multiple users, keeping track of which values were contributed by whom, and presents useful reports that summarize the impact of different scenarios on particular output cells. Quattro Pro for Windows and Excel also include scenario-management capability, but the Lotus version is the most versatile and group-aware.

As you might expect, all three major spreadsheet vendors are determined to

include more and better workgroup functionality in their products. Excel 5.0 will introduce a new Routing Slip feature, allowing users to mail spreadsheets to a specified group of recipients in sequence, with transport services provided by MAPI or VIM. Lotus has added a feature called Notes/FX (for field exchange) to a slipstream update for 1-2-3 for Windows (Release 4.01; registered users of 1-2-3 for Windows should have received this update by now). The Notes/FX feature lets you publish designated ranges of 1-2-3 worksheets to a Notes database, thus creating a bidirectional link with the database.

The most ambitious workgroup feature in this year's spreadsheet crop, though, is Borland's Workgroup Desktop, the first manifestation of the company's new OBEX (object exchange) technology. Workgroup Desktop uses a publish-and-subscribe system for sharing ranges, pages, or entire files. Its advantages over competing technologies are that it requires no additional software, it allows you to publish (and automatically update) documents up to several revision levels, and it makes available a broad selection of transport services, including MAPI, MHS, VIM, MCI Mail, and your unadorned local-area network.

PIVOTAL YEAR

1993 was the year in which Lotus introduced Improv for Windows, Version 2.0, the first mainstream-platform implementation of its multidimensional modeling tool. Because it creates models in a row-column-page format, Improv has much in common with the traditional spreadsheet program. But because its formulas are not stored on the worksheet grid and generally avoid positional referencing, and because Improv is designed specifically to model data that doesn't fit comfortably in conventional spreadsheets, we have decided not to include it in this survey. For a recent review of Improv 2.0 (plus a preview of Computer Associates' comparable CA-Compete!), see "Alternative Views: New Dimensions in Spreadsheets," in our issue of September 28, 1993. Lotus

itself, while describing Improv as the "first dynamic spreadsheet," is not positioning the product as an advanced alternative to 1-2-3 for Windows (as 1-2-3 for DOS, Release 3.x, was a high-end alternative to 1-2-3 for DOS, Release 2.x). Rather, Lotus is presenting it as a standalone or accessory tool for handling a specific kind of modeling need.

Lotus's competitors, meanwhile, have responded to Improv by designing powerful report generators that take multidimensional data, in the form of conventional database records, and present it in a malleable tabular format. An Excel 5.0 pivot table or a table created via Quattro Pro for

*Spreadsheet vendors are
determined to include better
workgroup functionality
in their products.*

Windows' Data Modeling Desktop looks strikingly like an Improv worksheet. And you can transpose the field arrangement in these tables, using almost exactly the same techniques you would use to modify the data slice shown in an Improv view. But there are important differences among Improv's capabilities and those of the new Excel and Quattro Pro for Windows features. For further details, see the sidebar "Spreadsheets: Added Dimensions."

HIGH ROAD, LOW ROAD

This year's field of Windows spreadsheets consists exclusively of high-ground entries—the massively powerful, resource-consuming, memory-intensive, hard-disk-eating analytic behemoths. In our next review, it's likely you'll see a few products that exploit the lower elevations. There is certainly room in Windows for spreadsheets that load and depart quickly, use less than 10MB of disk space, avoid overwhelming your system resources, and do all of the basic computational and reporting tasks effectively. This niche is available and will almost certainly be occupied, notwithstanding the fact that Borland is selling its powerhouse at sub-\$100 prices. Lucid 3-D for Windows appears to be aimed in this direction.

Meanwhile, although this year's products are few in number, they are richer than ever in every other sense. For details, read on.

Our Contributors: CRAIG

STINSON is a contributing editor to *PC Magazine*. JOHN W. SULLIVAN is a computer industry consultant and developer. TED STEVENSON was the associate editor in charge of this story, and BEN Z. GOTTESMAN was the project leader.

Benchmark Tests: Spreadsheets

With the introduction of Lotus 1-2-3 for Windows, Release 4.01, Lotus Development Corp. has made great strides in improving the functionality, usability, and performance of its Windows product. Just beware of the cut-and-paste commands.

What the Numbers Mean

Microsoft Excel for Windows, Version 4.0, proved to be the fastest product in our last spreadsheet roundup (November 10, 1992). Since Excel for Windows 5.0 was not ready for this roundup (PC Magazine Labs will not run performance tests on beta software), we ran our new performance tests on Version 4.0 to see how it would stack up against the competition and vice versa.

1-2-3 for Windows is now roughly on a par with Excel in terms of performance, but Quattro Pro for Windows lagged far behind on most of our tests. Of the DOS products, Lotus 1-2-3 for DOS is often at least slightly faster than Quattro Pro for DOS. This is most likely a negative result of Borland's wish to have Quattro Pro run on all systems, down to XT compatibles; the tested version of 1-2-3 for DOS will run only on 286 systems and higher.

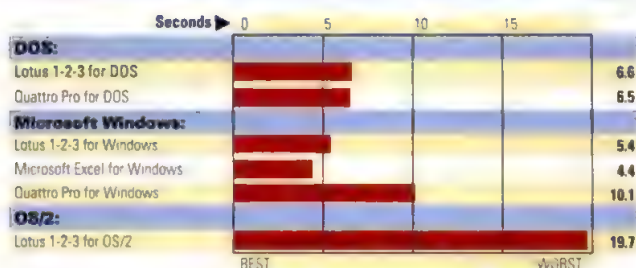
Lotus 1-2-3 for OS/2 failed to show the performance benefits of a multithreaded 32-bit application. The program struggled just to load our large recalculation spreadsheet, taking more than ten times as long as any other product. It finished dead last in 8 of 14 cases.

Our Recalculation test led to interesting results. Each program has a minimal recalculation feature that lets it calculate only the cells affected by a change in the spreadsheet, rather than recalculating the whole model. We tested this feature twice, changing single cells in two different areas of the spreadsheet.

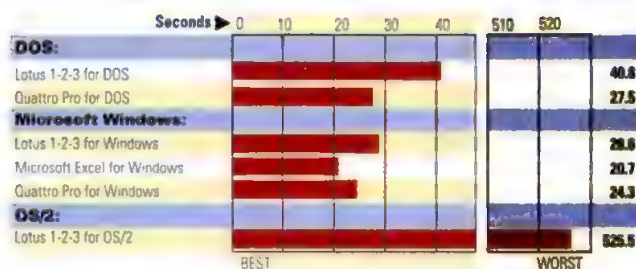
In conducting this test and making those changes, we found that Excel evaluates each change using several criteria to determine whether an attempted minimal recalculation is most efficient. According to Microsoft, this helps lower each spreadsheet's overhead. But the result was that the program performed a full recalculation on one task ("selected cells"), where every other program saved time by performing only a partial recalculation. When minimal recalculation did work ("financial section"), Excel had the fastest time of the bunch.

The Windows and OS/2 products that have roots in DOS (1-2-3 for OS/2, 1-2-3 for Windows, and Quattro Pro for Windows) all had problems with our Cut-and-Paste test. 1-2-3 for Windows took nearly 40 minutes to perform the test, which involves copying a block of 70 rows and 256 columns using the Edit/Cut and Edit/Paste commands.

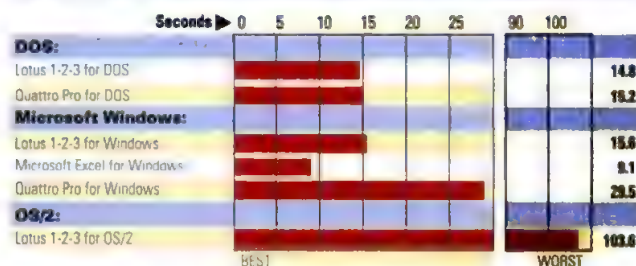
PROGRAM LOAD FROM DISK



FILE LOAD FROM DISK



FILE SAVE TO DISK



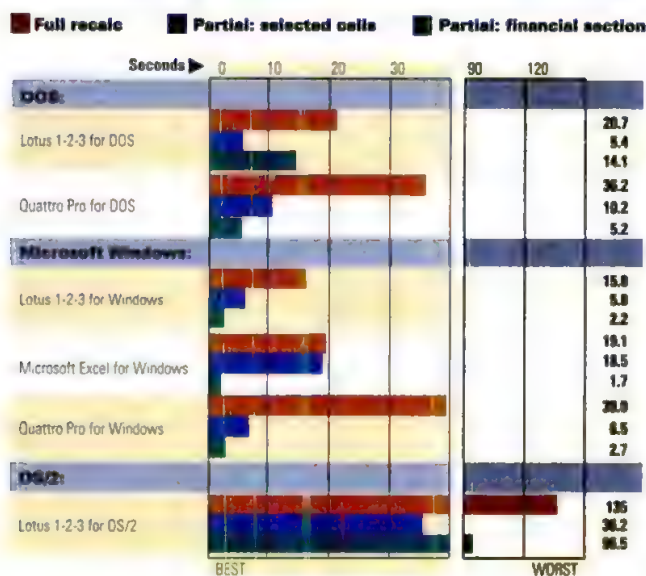
Each of these three products also lets you move via its own internal clipboard, which we tested in our Move test. All of the Lotus applications use the /Move command. In Quattro Pro for DOS, you use the /Edit Move command; in Quattro Pro for Windows, you use the /Block Move command. Quattro Pro for Windows was nearly four times as fast using move rather than cut-and-paste. 1-2-3 for OS/2 was 17 times as fast, and 1-2-3 for Windows was almost 1,000 times as fast!

How We Tested

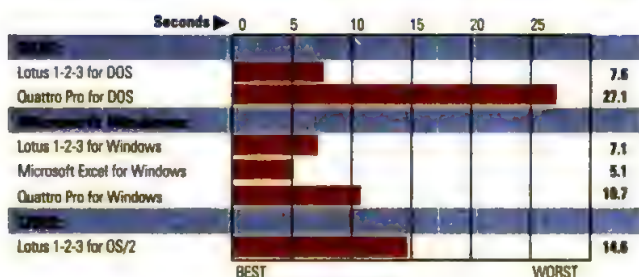
We tested all the spreadsheets in this roundup on Compaq Deskpro 486/33M units equipped with 340MB hard disks and 8MB of RAM. Each machine ran DOS 6.0 and, for the Windows spreadsheets, Microsoft Windows 3.1. We tested the OS/2 application under OS/2 2.1.

Of the DOS applications, Lotus 1-2-3 for DOS used its own internal memory management, and Quattro Pro for DOS used DOS's EMM386 to provide expanded memory. We generated text files in either .WK1 or .WK3 format and imported them into each package. We translated formulas into the syntax of

RECALCULATION



DATABASE SORT



the program being tested and saved the files in the program's native format. We tested all the packages with Recalc set to manual, with Undo features disabled wherever possible to improve performance. In all cases, a shorter time is better.

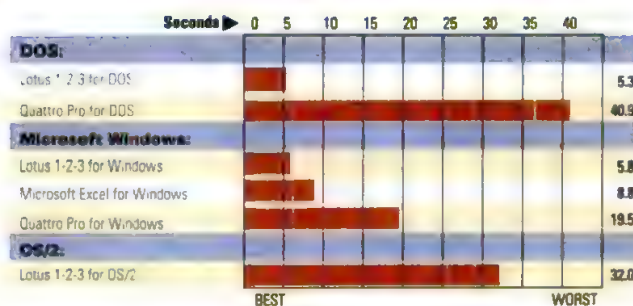
The **Program Load** test measures the time the application takes to load from disk into memory and await input.

The **File Load** test measures the time the program takes to load our recalculation test file from disk.

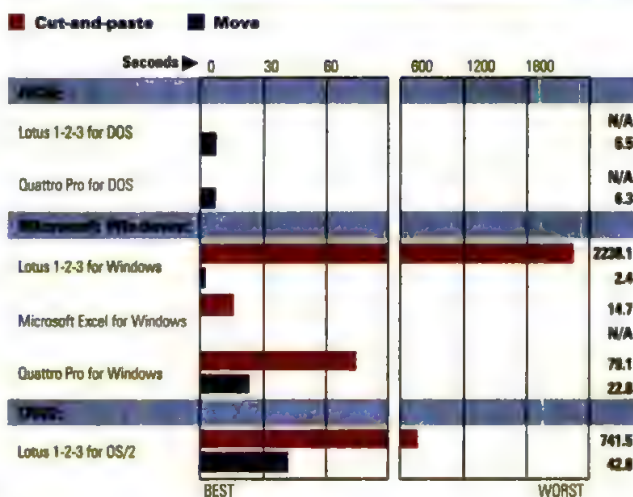
The **File Save** test measures the time the program takes to save the same file to disk.

Our **Recalculation** test file uses a combination of mathematical, lookup, time/date, financial, and string functions. The test is split into three subtests: one complete recalculation of all the formulas in the spreadsheet and two partial calculations. The first partial recalculation affects a small portion of every section of the spreadsheet. The second partial recalculation affects only the financial section of the spreadsheet.

SEARCH-AND-REPLACE



CUT-AND-PASTE/MOVE



N/A—Not applicable. The program does not support this operation.

The **Database Sort** test times a two-key sort on a database of 5,000 rows and 13 columns. The primary field is sorted in ascending order; the secondary field is sorted in descending order.

The **Search-and-Replace** test measures the time it takes to change more than 200 instances of "MISC" to "WXYZ" in our database file.

Our **Cut-and-Paste** test measures the time that is required to move a large block of rows from one area of the recalculation spreadsheet to another. This move is made via the operating system's clipboard, with recalculation set to manual. Moving the rows causes formulas in cells throughout the spreadsheet to be updated.

Our **Move** test involves the identical task as the Cut-and-Paste test, but uses each program's internal clipboard.

Our **Print** test uses a heavily formatted spreadsheet containing both text and graphics. We measure the time it takes for control of the system to be returned to the user and for the document to finish printing on an HP LaserJet 4M. We run separate versions of the test in both PCL5 and PostScript modes.



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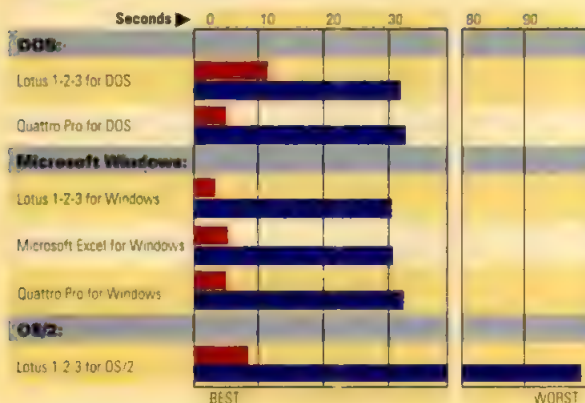
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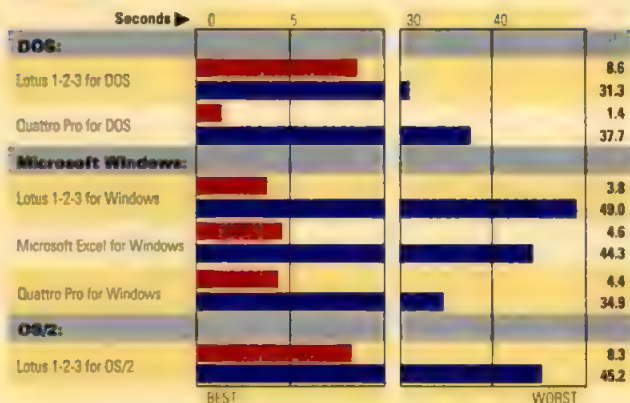
PRINT: PCL5 MODE

PRINT: POSTSCRIPT MODE

■ Control returned ■ Printing completed



■ Control returned ■ Printing completed



N/A—Not applicable. The program does not support this operation.

Lotus Development Corp.

Lotus 1-2-3 for DOS, Release 3.4a

BY CRAIG STINSON

The \$595 1-2-3 for DOS, Release 3.4a, is Lotus's top-of-the-line DOS spreadsheet. After years of playing a poor second fiddle on performance tests to the same company's 1-2-3 for DOS, Release 2.x, Release 3.x now more than holds its own.

SUITABILITY TO TASK

Lotus 1-2-3 for DOS

	POWER	EASE
Analysis and model building	Fair	Fair
Charting	Fair	Fair
Worksheet presentation	Fair	Fair
Interoperability	Fair	Fair
Applications development	Good	Good
Workgroup support	N/A	N/A

In upgrading Release 3.1+ to Release 3.4a, Lotus gave its high-end spreadsheet some impressive performance tweaks, allowing Release 3.4a to recalculate worksheets about 20 percent faster than Release 3.1+ does—at speeds comparable to those of Release 2.4. On very large worksheets, Release 3.4a outguns Release 2.x handily, because it doesn't require expanded memory.

Other Release 3.4a enhancements include the now-familiar SmartIcon palette, some three-dimensional graph types (you can now plot multiple series in separate z-axis planes), support for landscape mode on dot-matrix printers, optional setting sheets, and a trace facility that reports the address of the currently executing macro command. In nearly all respects, the user interface of Release 3.x is now as up to date as that of Release 2.x.

THANKS FOR THE MEMORY

One of Release 3.x's major strengths remains its support for extended memory. Provided you have a 286 computer or better, the program can use every bit of memory you give it, which means it can handle extremely large worksheets without swapping pieces of itself in and out of memory. On the downside, you need an absolute minimum of 1MB of RAM to run the program (1.5MB is recommended), and you need 2MB or more if you want to use its Solver add-in. Therefore, Release 3.4a appears to be aimed at a diminishing population of users—those who either don't want to run Windows or are just under the hardware threshold required by Windows.

Lotus has vowed to continue upgrading its DOS spreadsheets. (The next version of 1-2-3, due by early 1994, will merge Releases 2.x and 3.x and provide notebook-style navigation among worksheet pages.) But it's obvious that the major R&D will take place on the other side of

the divide. Release 3.4a's SmartIcons look more or less like the ones in 1-2-3 for Windows and Improv, but this release offers none of the workgroup-oriented features (such as mail enabling, Notes integration, and scenario management) that Lotus is infusing into its Windows line.

Lotus 1-2-3 for DOS, Release 3.4a, does have one important strength in common with 1-2-3 for Windows, however, and that strength should give it the edge over its DOS competition, for a certain class of users: The program's DataLens facility allows Release 3.4a worksheets to tap into

FACT FILE

Lotus 1-2-3 for DOS, Release 3.4a

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-343-5414, 617-577-8500; fax, 617-693-3899

List price: \$595 (upgrade price, \$129)

Requires: 1MB RAM, 6MB hard disk space, DOS 3.0 or later.

In short: Extended memory support and access to external data are Release 3.4a's strongest features.

But the software lacks SmartIcons; enhanced graphing and printing tools capabilities; and workgroup-oriented features. Current users of Lotus's DOS 2.x line must weigh 3.4a's ability to execute unmodified 2.x macros against its limited support for 2.x add-ins.

441 ON READER SERVICE CARD

▪ Spreadsheets: *Added Dimensions*

by Craig Stinson

If you've ever attended a demo of CA-Compete! or Lotus Improv for Windows, you've probably noticed there are two features that consistently draw the biggest applause: the ability to let you change the slice of data displayed in a table by dragging field headings and the ability to let you construct formulas using descriptive labels instead of cell references. These features allow you to analyze multi-dimensional information from many different perspectives, and they provide a self-documenting way of identifying critical inputs, outputs, and relationships. The plain-English labels also allow a relatively small number of "general" formulas (such as "Sales-COGS") to replace a large sequence of "positional" formulas

Excel for Windows and Quattro Pro for Windows include sophisticated cross-tabulating report generators that mimic the transposable tables built by CA-Compete! and Improv.

LABEL IT ENGLISH

These new features, Microsoft's PivotTable Wizard and Borland's Data Modeling Desktop, first ask you to specify a traditional spreadsheet-style database—a worksheet table topped by labels serving as field names. Then you use the mouse to position field headings along the axes of an interactive table-layout form. You can put as many fields as you like on each axis. In Excel (but not in Quattro Pro for Windows), you can also position fields along a page axis. Having arranged your fields, you tell

the program what data you want the table to summarize and whether you want it, say, totaled or averaged. This information becomes the body of your table.

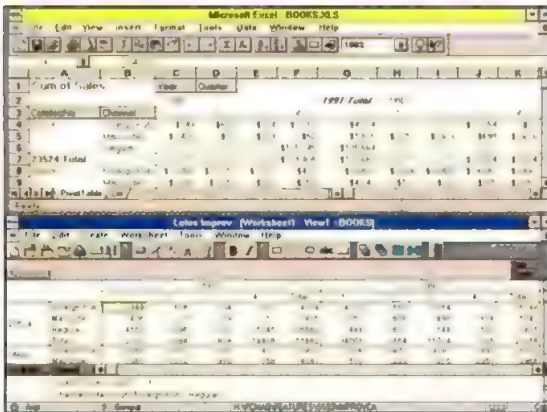
The result in both cases is a traditional "crosstab"—with one vital difference: You can reposition field headings with the mouse, just as you can change the organization of information displayed in a CA-Compete! worksheet or an Improv worksheet. Thus, with PivotTable Wizard and Data Modeling

=StockPrice-OptionPremium in each cell of column C. Cell C2 will concern itself only with the "StockPrice" and "OptionPremium" values in row two, C3 will look only at values in row three, and so on. Quattro Pro for Windows does not let you modify formulas to this extent, but its new ability to build names on the basis of row-and-column intersections will go a long way toward making models more self-documenting.

NOT FOR MODELING

But PivotTable Wizard and Data Modeling Desktop are report generators, not modeling tools, and that's the crucial difference between them and what you get with the Lotus and Computer Associates products. To build an Excel or Quattro Pro for Windows crosstab that looks like an Improv worksheet, you must start with a list or database. To change the data (as opposed to your view of the data), you edit the database. In CA-Compete! and Improv, you can build that table from scratch, using constants and formulas. To change the data, you change a constant or a formula—just as you would in a conventional spreadsheet program.

Does this matter? Computer Associates and Lotus say it does. Microsoft and Borland say it doesn't (at least not enough to warrant the huge cost of developing new products). For the final answer, stay tuned. In the meantime, though, the Computer Associates/Lotus case would be a lot stronger if their products also had better tools for imitating Excel and Quattro Pro for Windows. Neither CA-Compete! nor Improv is particularly adept at accessing existing database files. For this task, a conventional spreadsheet program such as Excel, Lotus 1-2-3 for Windows, or Quattro Pro for Windows is still the tool of choice. □



Excel's PivotTable Wizard and Quattro Pro for Windows' Data Modeling Desktop (above) create tables that in some ways look and function like Improv worksheets.

(such as "B2-B1", "C2-C1", and so on).

Can traditional spreadsheets be strengthened to offer comparable benefits? Computer Associates International and Lotus Development Corp. say no and have invested large R & D efforts to create separate, advanced modeling tools. Microsoft and Borland International are betting yes. The latest versions of Microsoft

Desktop, you get the same viewing flexibility that is the hallmark of CA-Compete! and Improv.

As for descriptive names and general formulas, Excel has been offering these benefits since its first version nearly a decade ago. In any version of Excel, if you name column A "StockPrice" and column B "OptionPremium", you can write a general formula



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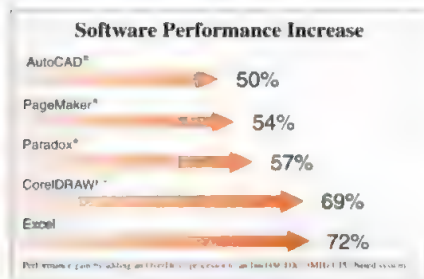
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SOFTWARE Spreadsheets

MACRO EXCLUSIVE

As a result of a recent court ruling, Release 3.4a is now the only DOS spreadsheet in our survey that can execute unmodified Release 2.x macros. If you're moving up from Release 2.x but staying in DOS, that may be the deciding factor.

On the other hand, Release 3.4a lacks Quattro Pro's ability to read entire .DBF files with a simple File Open command and requires a separate menu (that of the WYSIWYG add-in) for many formatting operations.

And the implementation of three-dimensionality in Release 3.4a, with its unnamable pages and fixed-position windowing, cannot compare in usability with that provided by the Quattro Pro spreadsheets. Furthermore, for all its power advantage over Release 2.x, Release 3.4a doesn't support many of the fine add-ins that are available for the 2.x line.

Thus the wavy bottom line: Release 3.4a is the spreadsheet of choice for those

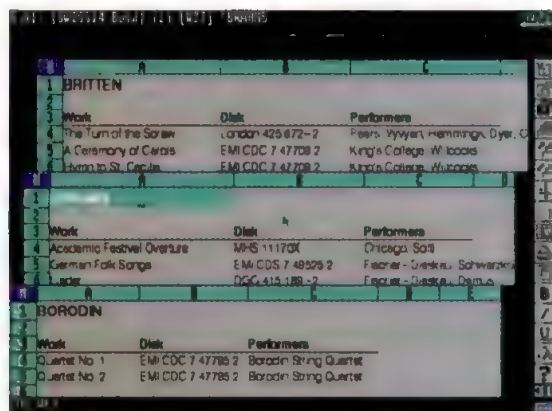
committed to DOS who have the requisite hardware or for those who don't require Release 2.x add-ins. It's a good choice also for users who value external connectivity or Release 2.x macro compatibility over Quattro Pro's elegantly designed user interface.

Lotus Development Corp.

Lotus 1-2-3 for OS/2, Release 2.0

BY BEN Z. GOTTESMAN

Users looking for a native OS/2 spreadsheet don't have a lot of choices these days. There's IBM's Spreadsheet—one of the productivity apps that ships with OS/2—and there's the \$495 Lotus 1-2-3 for OS/2, Release 2.0. (This version succeeds 1-2-3/G, which was one of the first mainstream applications released for OS/2 back in 1987.) And since IBM's Spreadsheet is too limiting for any serious spreadsheet user, there's basically one choice left.



Lotus 1-2-3 for DOS includes an optional SmartIcon palette similar to those used by Lotus's Windows programs.

selected records of external database files, using essentially the same querying mechanisms that would be applied to on-sheet databases.

Release 3.4a is shipped with DataLens drivers for dBASE III, dBASE IV, SQL, and Paradox 4.0, and some 35 additional drivers are available at extra cost, either directly from Lotus Development or from third parties.

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SOFTWARE *Spreadsheets*

Although this package was designed for OS/2 2.x, it's far from a state-of-the-art spreadsheet. True, it is a 32-bit, multi-threaded application, but on the whole, 1-2-3 for OS/2 is much more akin to 1-2-3 for DOS than it is to 1-2-3 for Windows, Release 4.x, and it fails to take much advantage of the inherent strengths of a graphical environment. Released only a few months before 1-2-3 for Windows 4.0, the program lacks any of the advanced usability and workgroup features of the Windows program, such as page tabs, auto-fill, drag-and-drop, and Version Manager.

SLOW PUP

On PC Labs' performance tests, 1-2-3 for OS/2 came to a virtual halt, taking nearly ten minutes to load our 2-D recal-

culational-test spreadsheet. By comparison, none of the other programs took more than 45 seconds to do this. And even though 1-2-3 for OS/2 runs recalculation on a separate thread, thus returning keyboard control quickly, the program's overall recalculation time was

the slowest of the packages we tested.

The program's default menus look like conventional GUI menus but in fact act like slightly deranged "classic" 1-2-3 for DOS menus. That is, options such as Copy, Move, and Quit are top-level menus

rather than subitems. Slightly more OS/2-like menus are available; simply select CUA Menus from User Preferences. As do Quattro Pro for Windows and Microsoft Excel for Windows, 1-2-3 for OS/2 supports use of the slash key to access these menus—a nice feature for

users of 1-2-3 for DOS who are making the transition to a GUI. 1-2-3 for Windows does not provide this option.

BAD HABITS

Several of 1-2-3 for OS/2's interface behaviors are likely to annoy experienced OS/2 and Windows users alike. For example, you must release the Alt key before pressing a menu letter. Further, Help runs only in the foreground, so once you call it up, you have to remove it from the screen before proceeding with your work. Also, the command to close a spreadsheet is Worksheet/Erase, rather than the more standard File/Close.

1-2-3 for OS/2 adds a new file format, .WG2, to the 1-2-3 family. A single .WG2 file in 1-2-3 for OS/2 stores both data and formatting information, just as a .WK4 file does in 1-2-3 for Windows. As in 1-2-3 for DOS, Release 3.4a, the spreadsheets in 1-2-3 for OS/2 are three-dimensional; each page is identified by a letter, but there are no page tabs to let you move quickly among pages.

The analytic tools in 1-2-3 for OS/2 are

SUITABILITY TO TASK		
Lotus 1-2-3 for OS/2		
	POWER	EASE
Analysis and model building	Fair	Fair
Charting	Fair	Fair
Worksheet presentation	Fair	Fair
Interoperability	Good	Good
Applications development	Good	Good
Workgroup support	N/A	N/A

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Programming Spreadsheets

by John W. Sullivan

A spreadsheet package is essentially an environment for developing applications—even the simplest formula is a line of programming. But a rich macro language will let you take spreadsheets much further.

At their most basic level, macros can be used to automate repetitive tasks by recording the user's keystrokes. But spreadsheet programming can go far beyond that. Macros let you harness the powerful tools that mark today's spreadsheets—like sophisticated analysis functions, page-layout and graphics features, charting capabilities, and database linking. You can customize the way you use these tools—even to such an extent that you don't even realize you're using a spreadsheet. In the process, you can shelter users from a lot of intimidating functionality.

APPLICATION SPECTRUM

Custom spreadsheet applications range from simple time sheets or expense vouchers to sophisticated data-gathering and financial-analysis tools generating detailed reports and charts. Since spreadsheets have utilities for attaching to central database servers or external database tables, they can assist users in accessing centrally stored data, from customer lists to sales and financial information.

But you don't have to build complex applications to take advantage of the power of macro programming. Most macros automate one or two operations in a standard spreadsheet. A macro can consist of anything from a single command to many hundreds of commands linked together in sequence, written and stored in either the worksheet where they'll be called or a separate sheet, referred to as a macro library.

LOTUS 1-2-3 FOR WINDOWS

The macro language of Lotus 1-2-3 for Windows, Release 4.01, comprises

approximately 300 commands, organized into 18 categories. Some of these commands correspond to 1-2-3 for Windows' standard menu commands; others control the user interface and environment. "Flow-of-Control" commands handle branching, subroutine calls, and conditional processing.

You build macros by using 1-2-3 for Windows' macro recorder or by typing in the commands manually. In recording



The clear identification, neat presentation, and systematic documentation of this five-line Lotus 1-2-3 macro indicate good programming habits.

macros, you execute commands through the menus or via keyboard shortcuts; the software then records the corresponding macro commands in a *transcript*. Macros that pause for user input or depend on a condition to execute activities must be built manually. To execute 1-2-3 for Windows macros, you either use the Macro Run command or attach them to Macro Buttons, SmartIcons, custom menus, or menu items.

With the Lotus Dialog Editor that ships with 1-2-3 for Windows, you can create custom dialog boxes for user interaction. Since these boxes behave the same way as built-in dialog boxes, your application can have the same type of interface as 1-2-3 for Windows itself. The company provides samples of all the user interface commands in action; you can copy example code into your own macros.

Whenever a macro runs, 1-2-3 for

Windows checks each line for spelling and syntax, informing you of errors and identifying the offending line. Some errors, such as commands placed in the wrong order, are difficult to spot when a macro is running at normal speed. For debugging (finding and correcting) macro errors, 1-2-3 for Windows provides special commands called Step and Trace. Step executes a macro a line at a time at the click of the mouse (or press of a key). The more useful Trace command opens an extra window that displays each command as it is executed.

Mindful of its installed user base and what must be a gargantuan amount of existing macro code, Lotus Development Corp. provides macro compatibility with the DOS versions of 1-2-3. You can use the 1-2-3 Classic menus in 1-2-3 for Windows to record or run keystroke macros compatible with DOS versions of 1-2-3. As an alternative, Lotus offers a Macro Translation utility, run as a separate application, to convert keystroke macros into function-based, 1-2-3 for Windows macros. The translator has its limits, though; "What's New," a book that ships with 1-2-3 for Windows, contains details.

QUATTRO PRO FOR WINDOWS

Like 1-2-3 for Windows, Quattro Pro for Windows, Version 5.0, Workgroup Edition, contains a powerful macro language, with 200 categorized commands and more than 300 "command equivalents" that match every menu command and option in the program. Like 1-2-3 for Windows, Quattro Pro for Windows lets you record macros or type them command by command, but its macro recorder gives you a choice of recording either in "logical" format, with commands represented by their menu equivalents, or "keystroke" mode, which duplicates your actual keystrokes.

Like 1-2-3 macros, Quattro Pro for Windows macros may be executed via commands or called from either custom menu items, SpeedButtons, or graphical objects. Borland International also provides macro compatibility with its DOS package. You can run DOS-based menu-equivalent macros in the Windows version without modification by configuring the package to interpret keystroke macros directly.

Unlike those in 1-2-3, Quattro Pro for Windows' related utilities take a sophisticated programming approach. The Debugger function not only lets you step through the macro commands in sequence, but it displays both the previous and next commands for reference. The Trace function, rather than simply displaying the command being executed, lets you specify cells whose contents will be monitored while the macro is run. Since cells frequently function the way variables do in other programming languages, you can, in effect, monitor variables during the course of the macro.

The most radical difference between Quattro Pro for Windows macros and

graphical objects on the notebook's Graphs page rather than in the form of a description table in a worksheet. You can manipulate the dialog box and its components (text, buttons, list boxes, radio buttons) as discrete objects and call them by name from a macro. You can link each component object to a macro or function based on the occurrence of an event, such as a mouse click or double click. The sample files that ship with Quattro Pro for Windows have many detailed macro examples, which can be copied into your own workbooks or used as starting points for your own development.

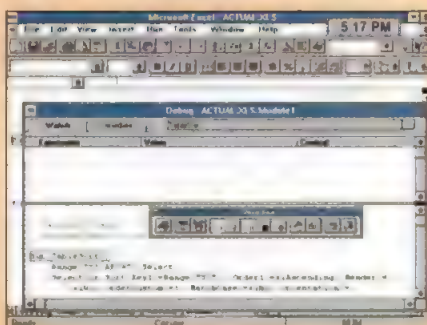
MICROSOFT EXCEL

By the time you read this, Microsoft Excel will have not one but two programming languages: the .XLM macro language, native to Microsoft Excel for Windows, Version 4.0 and earlier versions, and Visual Basic, Applications Edition, which will be shipping with Microsoft Excel for Windows, Version 5.0. The .XLM language is available in Excel 5.0 primarily for compatibility with previous versions of Excel. Although it has been updated to include new functions for this release, Microsoft will not update the .XLM language after Release 5.0.

Visual Basic, Applications Edition, Microsoft's new global macro language, is in fact not a macro language at all. It is an applications programming language, which the company plans to add to all its major Windows applications. The learning curve for a novice Visual Basic user is steep, but getting started is simple: You use the macro recorder to record *procedures* (the new term for *macros*) directly into Visual Basic *modules*, which appear as separate sheets within the Excel workbook. Microsoft also provides an extensive array of printed reference materials.

A set of Visual Basic development utilities is completely integrated into Excel. Procedures are stored on Module sheets in the Excel workbook just as charts are stored on Chart

sheets. Custom dialog boxes are created and stored on Dialog sheets. A Visual Basic toolbar with debugging tools appears whenever a Module is active, and a Forms toolbar appears whenever a dialog sheet is active. The Menu Editor simplifies the creation and editing of custom menus. The Visual Basic debugger is a true pro-

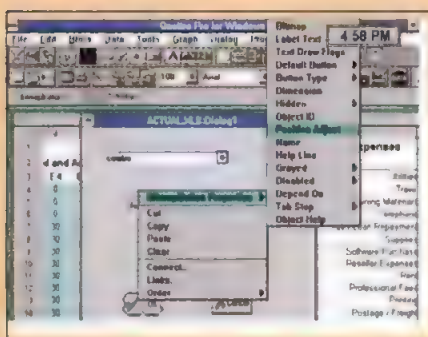


The indentation of program text marks this Excel subroutine as Visual Basic (rather than traditional macro) programming. Note the Visual Basic toolbar.

grammer's tool, letting you monitor not only the code but also expressions whose value might change during the execution of a procedure.

You can place virtually any Visual Basic control—button, list box, check box, radio button—directly on a worksheet or chart and link it to a procedure or set it to respond to an event (such as a mouse click). Since any sheet in an Excel workbook can function as a Visual Basic form, you can transform Excel into an entirely different application.

Thus, Microsoft addresses well the needs of Excel 4.0 developers moving to Visual Basic. There is no direct conversion between .XLM macros and Visual Basic procedures, but existing Excel 4.0 macros will run in Excel 5.0. You can also call .XLM macros directly from Visual Basic procedures, integrating them into new applications without rewriting. Conversely, you can enhance your existing .XLM macros by adding calls to Visual Basic procedures. An appendix in the Visual Basic user guide addresses the questions .XLM macro developers might have regarding upgrades. □



When building a Quattro Pro dialog box, you select controls (pick lists, radio buttons, and so on) and assign properties to them.

1-2-3 macros is in the construction and management of custom dialog boxes. With its integrated UI (user interface) Builder, Quattro Pro for Windows places us firmly in the school of object-oriented programming. The UI Builder is in the Tools menu in the main program rather than in a separate application. Also, dialog boxes are stored as

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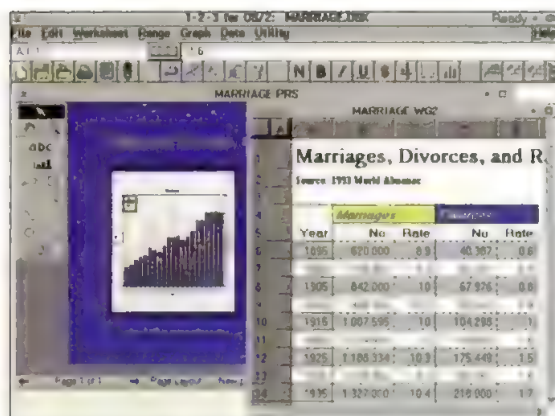
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SOFTWARE Spreadsheets



Lotus 1-2-3 for OS/2 is tightly integrated with Lotus's Freelance Graphics for OS/2 and includes the same graphics engine.

very similar to those in 1-2-3 for DOS, Release 3.4a, except that 1-2-3 for OS/2 omits the Auditor tool, which is used to analyze spreadsheet structure. 1-2-3 for OS/2 can be used as a database front-end using Lotus's DataLens drivers. Lotus provides drivers for Database Manager for OS/2, dBASE, Oracle, Paradox, and SQL Server.

CHARTING A CROOKED COURSE

Charting is a confusing task with this package. The Graph menu opens a chart in a separate window. If you copy this chart into the spreadsheet, it loses its link to the original data. To embed a chart

ter—for each worksheet.

You can create sophisticated macros within 1-2-3 for OS/2, including custom dialog boxes and menus. Unfortunately, the debugging tools are minimal. Programmers will appreciate being able to create custom functions using C or OS/2's REXX programming language.

ALLIANCES

1-2-3 for OS/2 is tightly integrated with Freelance Graphics for OS/2 2.0. They share a great deal of common code, including a common charting module. Freelance presentations can be opened alongside spreadsheets within 1-2-3 for OS/2 and saved in a common file called a Desktop. Lotus plans to release a SmartSuite of OS/2 applications similar to their Windows suite, including cc:Mail for OS/2 and the soon-to-be-released Ami Pro for OS/2.

Despite the release of SmartSuite for OS/2, one must wonder if Lotus is really serious about the OS/2 market. If it is, it should put out a serious spreadsheet. To say the least, it's disappointing that so little of the care and thought that went into 1-2-3 for Windows, Release 4.01, is reflected in the OS/2 product that so shortly preceded Release 4.01 to market. For now, OS/2 users who need a spreadsheet would be well-advised to consider running 1-2-3 for Windows or one of the other Windows products in a WIN-OS/2 session.

Lotus Development Corp.

1-2-3 for Windows, Release 4.01

This year's honors for the most improvement in a revised spreadsheet product go hands down to Lotus Development Corp. for Lotus 1-2-3 for Windows, Release 4.01. In the \$495 1-2-3 for Windows, Lotus finally presents a solid Windows spreadsheet, a credible reason for Lotus shops to migrate to the graphical environment, and a worthy suite-mate for Freelance Graphics and Ami Pro.

1-2-3 for Windows now shares a common user interface with Lotus's other Windows applications. The interface includes a set of customizable SmartIcon palettes and an interactive status bar that lets you pick fonts and formats from convenient pop-up lists. Though the program retains the "classic" Lotus menu system (which is still accessed by the slash key), its native Windows menus and dialog boxes have been wholly and effectively revamped. Classic menus aside, most of the ways in which the previous version violated de facto Windows conventions have been eliminated. There is, however, one notable exception: Changes made to the default printer made in Print Manager are ignored by 1-2-3 for Windows.

While cleaning up its Windows act in many ways, 1-2-3 for Windows, Release 4.01, has also adopted the most well-received of its competitors' innovations

FACT FILE

Lotus 1-2-3 for OS/2, Release 2.0

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 800-343-5414, 617-577-8500; fax, 617-693-3899

List price: \$495 (upgrade price, \$129)

Requires: 4MB RAM, 8MB hard disk space, IBM OS/2 2.0.

In short: Lotus's OS/2 product builds on 1-2-3's DOS history and falls far short of the successful

GUI implementation of 1-2-3 for Windows. It delivers sluggish performance and some limited toolsets. Strengths are good macro capability and integration with Freelance. Ultimately, this product will be part of an entire SmartSuite for OS/2.

ON READER SERVICE CARD

The screenshot shows the Lotus 1-2-3 for Windows Release 4.01 interface. A SmartIcon palette is visible on the top of the window, and a status bar is at the bottom. The main window displays a list of songs and performers.

Work	Desk	Performers
1. American Festival Overture	MHR 111705	Chicago S&H
2. German Folk Songs	EMI CD 485252	Fischer-Dieskau, Schwarzkopf, Moore
3.lieder	Clara 415 1892	Fischer-Dieskau, Demus
4.lieder	Accanto 41501	Fischer-Dieskau, Jahn
5.lieder	MHR 511 5599	Gies, Berliner Phil. Jochim
6.lieder	MHR 511 5599	Gies, Berliner Phil. Jochim
7.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
8.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
9.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
10.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
11.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
12.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
13.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
14.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
15.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
16.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
17.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
18.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
19.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim
20.lieder	Clara 415 1892	Gies, Berliner Phil. Jochim

With its SmartIcon palette on top and status bar below, Lotus 1-2-3 for Windows looks similar to other Lotus SmartSuite applications.

Keeping it Simple and Lucid

by Ben Z. Gottesman

Rather than do battle in the corporate market with spreadsheet behemoths Borland International, Lotus Development, and Microsoft Corp., Lucid Corp. has decided to target its newly released Lucid 3-D for Windows, Version 1.1 (\$109.95), at the small-office and home markets. In doing so, the company is focusing on simplicity and ease of use. Instead of features like sensitivity tables and goal-seeking tools, Lucid 3-D for Windows offers FastForms—spreadsheet templates for common tasks like creating expense reports and budgets. In addition, users of palmtop versions of Lucid's spreadsheet will be able to exchange files between their desktop and palmtop computers with ease. Support for Casio BOSS palmtops is included with the product, and connectivity packages for other palmtops are available from the company.

Unlike Lucid 3-D—the package's DOS predecessor and a member of our last spreadsheet roundup—Lucid 3-D for Windows truly earns the right to use 3-D in its name. It has added "layers" to the row-and-column spreadsheet metaphor. As with most of the other spreadsheets in this roundup, each layer has a nameable notebook tab. The default spreadsheet has 1,000 rows, 256 columns, and 26 layers, but you can specify from 1 to 32,000 elements in each dimension.

Some of the product's conventions are decidedly unconventional. You don't have to include a + or = operator at the beginning of a formula, for example. The package automatically detects which cells contain formulas and which contain labels. But there are drawbacks. If, for example, you're reporting on quarterly sales performance, the program will evaluate your Q1 through Q4 labels as the values of cells Q1 through Q4, unless you use a ', ^, or " operator at the beginning of the label.

The package lacks many of the functions found in Release 2.01 of Lotus 1-2-3. Used by most other spreadsheets, these database functions include DSUM, DMIN, and DMAX. The package makes up for this with many useful functions of its own, such as 3DLOOKUP, which finds the intersection of searches on rows, columns, and layers, and some fun functions, like

forms can be overwritten if you forget to use Save As rather than Save.

CUSTOMIZATION FEATURES

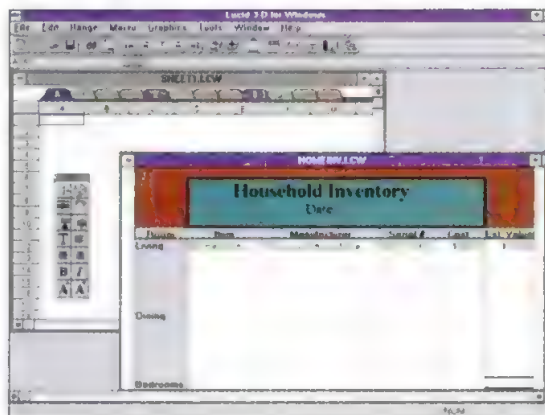
Although Lucid 3-D for Windows offers a good range of chart types, chart customization is limited. Furthermore, data that is to be graphed must be arranged in a very specific and confining layout, and the program will not chart noncontiguous ranges.

Yet spreadsheet layout options abound. You have extensive control of fonts, cell borders, color, and a full complement of drawing tools. You also have powerful control over number formats; numbers can appear in standard formats or as fractions, roman numerals, or words. And you can easily create custom formats.

The print commands lack a fit-to-page option.

Page setup controls include those for page size and margins, grid-line appearance, cell appearance (formula or result), and headers and footers. Within a header or footer, there are 12 variables for printing the time, date, filename, page number, or layer name.

It's going to be tough for a small player to survive today's vicious spreadsheet wars, and Lucid has wisely opted not to challenge the big three head on. But while it's true that many users don't need the depth of features offered by the heavyweights, Lucid 3-D for Windows isn't yet the perfect alternative. The package needs more depth in certain areas—especially charting—and the version we worked with had a significant number of bugs. Fortunately, there's a 30-day money-back guarantee, so you can give it a thorough tryout before committing. □



Lucid 3-D for Windows features FastForms templates, tabbed layers, and floating toolbars.

LOTTO\$(x,y), which returns x unique random numbers between 1 and y .

USABILITY FEATURES

Lucid 3-D for Windows supports both auto-fill and drag-and-drop cut and copy, and the right mouse button provides shortcuts to common commands and frequently used functions such as SUM and AVG. To avoid overwhelming users with icons (Borland and Microsoft, take heed), Lucid has used a system of hierarchical icon bars. When clicked, several of the top-level icons produce subordinate, task-specific icon bars, such as Edit, Range, and Graph.

And though the more than 50 FastForm templates target specific business and personal tasks, there is little intelligence in the forms. None of the cells in the spreadsheet are protected against being overwritten, and



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The four- or five-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

We carry only the latest versions of products. Version numbers are current at press time. Products listed here in red are Microsoft Windows Applications.

COMPUTERS

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9031	ProLinea 4/33S Local Bus, 120 MB, Win. \$1099.95
9894	ProLinea 4/33S Local Bus, 240 MB, Windows 1249.95
10894	ProLinea 4/50 Local Bus, 240 MB, Windows, PFS: WindowWorks, fax modem 1759.95
13553	Concerto 4/25 with pen, 250 MB, Windows for Pen Computing 2649.95
11420	Contura 4/25 with 209 MB, Windows 2199.95
11417	Contura 4/25C with 209 MB, Windows 2879.95
11646	DESKPRO 4/66M with 510 MB, Windows.. 3599.95
2016	LTE Lite 4/25 with 120 MB, Windows 2049.95
3029	LTE Lite 4/25E with 209 MB, Windows 3099.95
NEC	
13347	Ready 425es Local Bus, 170 MB, Windows.. 999.95
13346	Ready 433es Local Bus, 210 MB, Windows 1229.95
13345	Ready 466es Local Bus, 250 MB, Windows 1729.95
Monitors not included with Systems.	
Texas Instruments	
13312	TM4000E WinDX 2/50 Mono w/200 MB 2739.95
6441	TM 4000E WinDX2/50 Active Matrix 200 MB 3799.95
8934	TM 4000E WinSX/25 Notebook with 120 MB 1899.95
4696	TM 4000E WinSX/25 Passive Color 120 MB 2149.95
Toshiba	
13954	T1950CS Passive Color 120 MB 2499.
13953	T1950CS Passive Color 200 MB 2699.
13952	T1950CT Active Matrix with 340 MB 3399.

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3-D Visions	
8883	Stanford Chart for Windows 58 95
Borland International	
6788	Quattro Pro 5.0 for Windows (3 1/2" only)..... 44.95
10710	Paradox 4.5 for Windows (3 1/2" only) 145 95
11915	Borland Office for Windows 1.5 (3 1/2" only).... 239 95
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4277	OmniScan 289 95 8933 OmniPage Pro 2.1 489 95
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8798	DOS Headstart State Pkg. 24.95 8415 Win. 24 95
1663	TurboTax 1040 DOS (Headstart Edition) 39.95
3517	TurboTax 1040 for Win (Headstart Edition) .. 39 95
6221	Turbo Tax/Quicken DOS Bundle 54 95
3080	Turbo Tax/Quicken Windows Bundle 54 95
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6022	ClansWorks for Windows with Quicken Bundle 119 95
5257	FileMaker Pro Win. 119 95 5228 Comp Upgrd 95 95

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2426	Quicken 7.0 \$39.95 5596 3.0 for Windows \$39 95
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6882	PrintCache 3.1 59.95
Lotus	
10108	SmartSuite 2.1..... 439. 6233 Upgrade 289.
2756	1-2-3 4.0 for Windows (2755 5 1/4") 299.
3428	1-2-3 4.0 for Windows Upgrade (3424 5 1/4") 95.
13578	Ami Pro with Quicken Bundle 249
13577	Ami Pro with Quicken Competitive Upgrade 109
5005	Freelance Graphics 2.0 for Win (3523 5 1/4")... 335.
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2798	Managing Your Money 10.0 34.95
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3885	TaxCut for Windows (Headstart Edition)..... 12.95
11124	TaxCut State Packages (Headstart) ea. 29.95
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Software Marketing	
5145	BodyWorks 3.0 39.95 12714 PharmAssist Win. 39 95
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4402	Harvard Graphics 2.0 for Win (4403 5 1/4")... 269 95



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13953 T1950CS with 200 MB 2699.

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1625	ACT! DOS 2.11 259.95 7435 Windows 1.03 259 95
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3445	Presentations 2.0 Win. 299 95 7582 DOS 279.95
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12914	WordPerfect Win 299 95 12963 Ver. Upgrd. 99 95

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Abracadabra, Ltd.	
13046	Design Your Own Home - Architecture Windows 31.95

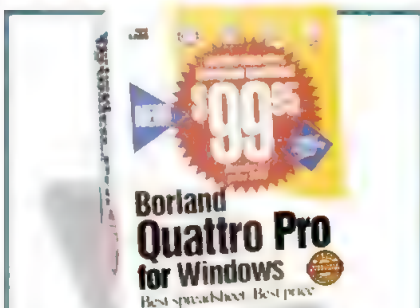


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10154 Visual Basic for Windows Standard Ed.—Fast object oriented programming language & access to data make this the most productive way to go from idea to application \$129.95
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11922 **WorldPort 14.4 Pocket FaxModem** 329.95
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PC CONNECTION



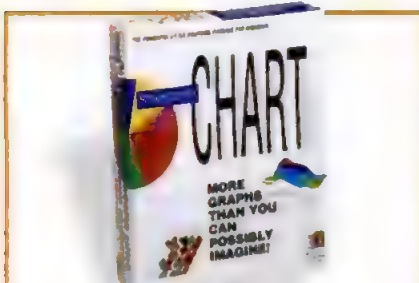
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12541 **386MAX 7.0 (3 1/2" only)**—New 386MAX version 7 makes DOS under Windows better than DOS itself. Get more conventional memory, a comprehensive memory tester and special support for DOS 6..... **\$47.95**

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13485 Professional Keyboard (P/N KB571).....	89.95
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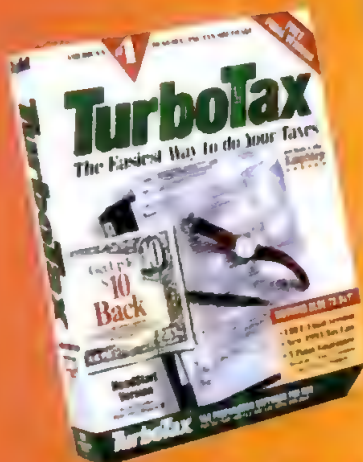
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SOFTWARE *Spreadsheets*

and contributed new ideas of its own. The program now features notebook-style page tabs, for example, and allows you to rearrange a single worksheet by dragging cells and ranges with the mouse. To automatically create commonplace label sequences, arithmetic series, or date series, you can type a one- or two-cell example and click a Smart-Icon. (By modifying an .INI file, you can also create your own custom "fill-by-example" sequences.)

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Lotus 1-2-3 for Windows

	POWER	EASE
Analysis and model building	Excellent	Good
Charting	Good	Excellent
Worksheet presentation	Excellent	Excellent
Interoperability	Excellent	Good
Applications development	Good	Good
Workgroup support	Excellent	Excellent

worksheet data where it lives instead of up on the formula bar. When you double-click on a cell or press F2, the cell's result is replaced on-screen by its input text (a label with a prefix in place, for example, or the text of a formula) and an insertion point appears, allowing you to edit. If the text is difficult to work with in that context (because, for example, you're using a small font), you can still edit in the conventional way by clicking on the formula bar. On the other hand, even when you're editing in the formula bar, a cell's input text will be displayed on the worksheet; because lengthy formula text can obscure adjacent cells, it would be nice if Lotus offered the option of turning this feature off altogether.

In-cell editing is one aspect of a larger theme: All work in 1-2-3 for Windows now takes place in a single context. Charts, for example, exist only as "drawing-layer" worksheet objects (but you can still use the classic-menu /GV command to see them in full-screen splendor). While a chart is selected, the menu bar activates chart-appropriate commands

► SUMMARY OF FEATURES

CONTINUES

Spreadsheets

PC MAGAZINE
EDITOR'S CHOICE

Products listed in alphabetical order	Lotus 1-2-3 for DOS	Lotus 1-2-3 for OS/2	Lotus 1-2-3 for Windows	Quattro Pro for DOS	Quattro Pro for Windows, Workgroup Edition
■ = YES □ = NO					
List price	\$595.00	\$495.00	\$495.00	\$99.95 (\$49.95 until Jan 15)	\$495.00
General Features					
Operating environment:					
LAN version available	■	■	■	■	■
Uses LIM EMS 4.0	■	□	N/A ①	■	N/A ①
Uses disk-based virtual memory	■	■	■	■	■
Uses Microsoft Windows	□	□	■	□	■
Supports Object Linking and Embedding as both client and server	N/A ①	N/A ①	■	N/A ①	■
Capacity:					
Worksheet grid dimensions (rows, columns, and pages)	8,192 x 256 x 256	8,192 x 256 x 256	8,192 x 256 x 256	8,192 x 256 x 256	8,192 x 256 x 256
Maximum number of open files	256	24	32	64	Unlimited
Hardware support:					
Supports math coprocessor	■	■	■	■	■
Supports mouse	■	■	■	■	■
Display modes	Text and graphics	Graphics	Graphics	Text and graphics	Graphics
Database-File Support					
Import/Export					
.DB	■ ■	■ ■	■ ■	■ ■	■ ■
.DBF	■ ■	■ ■	■ ■	■ ■	■ ■
Other	■ ■	■ ■	■ ■	■ ■	■ ■
Publishing-File Support					
Import/Export					
ALL	■ ■	■ □	■ □	■ ■	■ ■
FMT	■ ■	■ □	■ ■	■ ■	■ ■
FM3	■ ■	■ □	■ ■	■ ■	■ ■
WB1	□ □	□ □	□ □	■ ■	■ ■
.WQ1	□ □	□ □	□ □	■ ■	■ ■
XLS 3.0	□ □	□ □	■ □	□ □	■ ■
XLS 4.0	□ □	□ □	■ □	□ □	■ ■
Text-File Support					
Imports/exports tab-delimited files	□ □	□ □	■ □	■ ■	■ ■
Imports/exports comma-delimited files	■ □	□ □	■ □	■ ■	■ ■
User-defined delimiter	□ □	□ □	□ □	□ □	□ □
Worksheet-File Support					
Import/Export:					
DIF	■ ■	□ □	■ ■	■ ■	■ ■
SLK	■ ■	□ □	□ □	■ ■	■ ■
.WB1	□ □	□ □	□ □	■ ■	■ ■
WK1	■ ■	■ ■	■ ■	■ ■	■ ■
WK3	■ ■	■ ■	■ ■	■ ■	■ ■
WKS	■ ■	■ ■	■ □	■ ■	■ ■
.WQ1	□ □	□ □	□ □	■ ■	■ ■
WR1	■ ■	■ ■	■ □	■ ■	■ ■
XLS 3.x	□ □	□ □	■ □	□ □	■ ■
XLS 4.0	□ □	□ □	■ □	□ □	■ ■
Analytic Features					
Total number of functions					
Math and trigonometric	12	17	51	19	40
Date and time	13	13	19	12	33
Statistical	10	10	51	10	79
Financial	12	12	25	18	61
Database statistical	11	11	12	9	9
String	18	18	19	18	19
Logic	8	10	12	10	8

N/A ① — Not applicable: The feature is not compatible with the product's operating system

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and removes or dims everything else. Similarly, all database queries, whether to worksheet data or external files, occur on the worksheet and use the same procedures. Rather than call a separate query application, as you would do in Quattro Pro and in the forthcoming Microsoft Excel for Windows, Version 5.0, you operate from the worksheet through the mediation of a DataLens driver.

Although functional integration seems like a good idea (and the elimination of a separate .FM3 file for formatting information is particularly welcome), this new release's in-place chart editing can be somewhat awkward. Chart annotations, such as arrows and text boxes, are now graphic objects with the same status as the chart itself. This means you must "group" them to the chart or they will no longer point to the same chart elements if the chart is moved or resized. And because the Chart menu goes away when a group of graphic objects is selected, you must ungroup again to modify the chart's style or content.

FULLY FUNCTIONED

1-2-3 for Windows' function library has been augmented considerably and now includes specialized engineering and sta-

FACT FILE

Lotus 1-2-3 for Windows, Release 4.01

Lotus Development Corp., 55 Cambridge
Pkwy., Cambridge, MA 02142; 800-343-
5414, 617-577-8500; fax, 617-693-3899

List price: \$495 (upgrade price,
\$129).

Requires: 4MB RAM, 8MB hard
disk space, Microsoft Windows
3.0 or later.

In short: The hugely improved
1-2-3 for Windows, Release 4.01,

offers strong workgroup features, enhanced analytic tools, and a streamlined user interface, including in-cell editing and other integration features. In addition, 1-2-3 users moving from DOS to Windows have full macro compatibility. Still overly tied to its past, though, 1-2-3 for Windows lags behind the competition on a number of usability issues.

43 ON READER SERVICE CARD

SUMMARY OF FEATURES

CONTINUES

PC MAGAZINE
★★★★★
Best Spreadsheet Software

Products listed in alphabetical order

■ = YES □ = NO

Analytic Features (continued)

	Lotus 1-2-3 for DOS	Lotus 1-2-3 for OS/2	Lotus 1-2-3 for Windows	Quattro Pro for DOS	Quattro Pro for Windows, Workgroup Edition
Total number of other built-in worksheet functions	16	16	41	4	124
User can create custom functions	□	□	□	□	□
Add-in function libraries	■	□	■	■	■
Sensitivity tables	■	■	■	■	■
Matrix manipulation	■	■	■	■	■
Linear regression	■	■	■	■	■
Curve fitting	□	■	□	■	■
Goal-seeker	Add-in	Built-in	Built-in	Built-in	Built-in
Linear optimizer	Add-in	Built-in	Built-in	Built-in	Built-in
Nonlinear optimizer	Add-in	Built-in	Built-in	Built-in	Built-in

Auditing Features

	Formulas	Notes	Both	Formulas	Formulas
Text annotations in formulas or as attached notes	■	■	■	■	■
Text annotations via drawing-layer text boxes	□	□	■	□	□
Sound annotations	□	■	■	□	■
User can trace precedents and consequents of any formula	■	□	■	■	□
User can trace through all elements of circular-reference chain	■	■	■	■	■
Map mode to show location of cell types	■	■	□	■	□

Recalculation Abilities

Natural	■	■	■	■	■
Intelligent	■	■	■	■	■
Manual	■	■	■	■	■
Background automatic	■	■	■	■	■
Automatic for active worksheet only	□	□	□	□	□
User can specify number of iterations for circular-reference chain	■	■	■	■	■

Database Features

Search-and-replace	■	■	■	■	■
Sorts by row/column	■□	■□	□■	■□	■□
Maximum number of sort keys	255	255	255	5	5
Joins two database tables	■	■	■	■	■
Queries external database files	■	■	■	■	■
Includes database entry screen	□	■	(via macros)	□	■
User can develop custom data-entry screen	■	■	(via macros)	■	■
Crosstab generation command	□	■	■	□	■
Frequency analysis commands and functions	■	■	■	■	■

Formatting and Publishing

User can create named styles	□	□	■	■	■
User-definable numeric formats	□	□	□	□	■
Fractional formats	□	□	□	□	□
Displays negatives in parentheses	■	■	■	■	■
Value-dependent color settings	■	■	■	■	■
Aligns currency symbols and parentheses	□	□	■	□	□
User can customize currency symbols	■	■	■	■	■
Numbers can be centered or left-aligned	□	■	■	■	■
Displays formula text	■	■	■	■	■
Formatting cell by cell/sheetwide	■□	■□	■□	■□	■□
Centered text across multiple columns	■	□	■	□	■
Multiline labels	□	□	■	□	□



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tistical functions as well as a smarter set of date functions. In addition, to assist with formula building, there's an icon that summons a categorized list of the entire function set, complete with a syntax example, verbose description, and link to the help text. The manual, on the other hand, offers no function reference whatsoever; nor does it offer any reference material for the macro programmer. Network administrators may appreciate the slimmed-down docs, but independent consultants and others working solo will probably spend a lot of time dumping help text, item by item, to their printers.

Network users will also appreciate Release 4.01's mail support (both VIM and MAPI) and its classy new Version Manager. The latter is a scenario manager that's really tailored for the workgroup context. Unlike the corresponding components of Excel and Quattro Pro, Version Manager keeps track of which user contributed which version, or scenario. Additional benefits are provided for users of Lotus Notes: concurrent file access, automatic notification of changes to a worksheet, flags to mark unread versions, and the ability to grant varying permissions levels.

1-2-3 for Windows is currently out front in the technology of scenario management. It's also the easiest spreadsheet to use when it comes to querying on-sheet database records. (But see the sidebar on Excel 5.0 for a preview of an even stronger set of internal querying tools.) The ancient query and extract mechanisms, unchanged since 1983, have finally met their end in this newest release and have been replaced by a straightforward dialog box that diagrams your query unambiguously as you build it and lets you change your mind with a drag of the mouse.

MACRO COMMANDMENTS

For the macro programmer, 1-2-3 for Windows now offers a complete set of menu-equivalent macro verbs, a fine dialog editor (shared with its originator, Ami Pro), macro commands for creating standard alert boxes and pick lists as well as custom menus, and the ability to plant command buttons on the worksheet. There is still no debugger, but 1-2-3 users moving from DOS to Windows can take

► SUMMARY OF FEATURES

CONTINUES



Products listed in alphabetical order	Lotus 1-2-3 for DOS	Lotus 1-2-3 for OS/2	Lotus 1-2-3 for Windows	Quattro Pro for DOS	Quattro Pro for Windows, Workgroup Edition
■ = YES □ = NO					
Formatting and Publishing (continued)					
Vertically oriented text in labels	□	□	■	□	□
Maximum number of fonts per worksheet	8	20	Unlimited	Unlimited	Unlimited
Bold and italic variants treated as separate fonts	□	□	N/A ②	N/A ②	N/A ②
User can name and reuse font sets	■	□	■	N/A ②	N/A ②
Line drawings and borders	■	■	■	■	■
Cells can be shaded	■	□	■	■	■
Worksheets can show geometrical shapes	■	□	■	□	■
Graphs can be embedded on a worksheet	■	■	■	■	■
Graphing					
Maximum number of series per chart	6	23	23	6	Unlimited
Maximum number of points per series	8,192	Unlimited	Unlimited	8,192	Unlimited
Maximum number of points per chart	Unlimited	Unlimited	Unlimited	49,152	Unlimited
User can specify multiple series as a single range	□	□	■	□	■
Automatically parses multiple series based on range shape	■	□	■	□	■
Two-dimensional chart types supported:					
Vertical bar	■	■	■	■	■
Stacked vertical bar	■	■	■	■	■
Horizontal bar	■	■	■	■	■
Stacked horizontal bar	■	■	■	□	■
Line	■	■	■	■	■
x,y	■	■	■	■	■
Area	■	■	■	■	■
Pie	■	■	■	■	■
Multiseries pie	□	■	□	□	■
Pie-bar (100 percent bar)	□	□	■	□	■
Radar	□	■	■	□	■
High-low-close	■	■	□	■	■
High-low-close-open	■	■	■	■	■
Combinations	■	■	■	■	■
Text	□	□	□	■	■
Other	Table	Candlestick	None	Bubble	Donut
Three-dimensional chart types supported:					
Vertical bar	■	■	■	■	■
Vertical bar with each series in separate plane	■	□	■	■	■
Line (ribbon)	■	□	■	■	■
Area	■	□	■	■	■
Pie	■	□	■	■	■
Surface or wireframe	□	□	□	□	■
Other	None	None	None	3-D Step	Contour, 3-D, Donut, others
User can scale any axis manually	■	■	■	■	■
Logarithmic scaling for x- and y-axes	■	■	■	■	■
User can customize spacing between bar markers	■	■	■	□	■
Allows floating text annotations	■	■	■	■	■
Can attach annotations to individual data points	■	□	□	□	□
Annotations with arrows or freehand drawings	■	■	■	■	■

N/A ② — Not applicable: The product does not have this feature.

advantage of full 1-2-3 for DOS macro compatibility.

On certain important usability and "fit and finish" issues, however, Lotus still has catching up to do. For example, while notebook tabs make this release's three-dimensionality easier to use than 1-2-3 for DOS, Release 3.4's, they serve only as navigation icons and name-holders. You can't rearrange pages by moving tabs, as you can in Quattro Pro. Furthermore, you cannot select a range

*In-cell editing is one
aspect of a larger theme:
All work in 1-2-3 for
Windows now takes place
in a single context.*

of pages by clicking on tabs (you must use the keyboard instead). Group mode remains unchanged since the original (vintage 1987) 1-2-3 for DOS, Release 3.0; it neither allows you to work with a subset of your pages nor accepts multi-page data entry.

In addition, windowing features of the latest release of 1-2-3 for Windows are scarcely advanced over those of the previous version, Release 1.1. You can split your window horizontally or vertically, and you can put your document in a three-page, fixed-perspective view. But independently manipulable multiple windows are still beyond this release.

FURTHER DEFICITS

Users cannot hide rows, nor can they access the menu system from within the formula bar. Names can be assigned to cells and ranges only, not to expressions. Also, although page preview is serviceable, it does not allow adjustment of margins or header/footer positioning. The SmartIcon that builds charts in a single step fails to recognize a date series that should become a set of x-axis labels and it mishandles text associated with a single-series chart.

Furthermore, a named range used as source data for a DDE link is identified only by its cell coordinates (which makes

► SUMMARY OF FEATURES

CONTINUES

PC MAGAZINE
EDITORS' CHOICE

Products listed in alphabetical order	Lotus 1-2-3 for DOS	Lotus 1-2-3 for OS/2	Lotus 1-2-3 for Windows	Quattro Pro for DOS	Quattro Pro for Windows, Workgroup Edition
■ = YES □ = NO					
Graphing (continued)					
User can assign scaling factor to data-point labels	■	■	□	□	■
Automatically staggers data-point labels	■	■	■	■	■
Automatically rotates data points	□	□	□	□	□
Axes can be suppressed	■	■	□	□	■
User can specify cross points for axes	■	■	□	□	□
Can display or suppress grid lines	■	■	■	■	■
Can switch between color and monochrome palettes	■	□	□	■	■
Gradient fills available	□	□	■	□	■
Data-point marker customization:					
Border	□	■	□	■	■
Fill	□	■	□	□	■
User can replace standard markers with bitmapped images	□	□	□	□	■
User can customize chart background	□	□	■	■	■
User can replace chart background with bitmapped images	□	□	□	□	■
User can modify 3-D chart rotation, elevation, and perspective via menus/dialogs	□□	□□	□□	□□	■■
Macros					
Includes macro recorder	■	■	■	■	■
Allows worksheet-independent macro libraries	■	■	■	■	■
Autoload macros	■	■	■	■	■
Auto-close macros	□	□	□	□	■
Other event-triggered macros	□	□	□	□	■
Macros can create custom menus	■	■	■	■	■
Macros can create custom dialog boxes	□	■	■	□	■
Dialog editor	N/A ②	□	■	N/A ②	■
Macros can execute DOS commands	■	■	■	■	■
Macros can operate on records in external data files	■	■	■	■	■
Debugging features:					
Single-step trace	■	■	■	■	■
Conditional break points	□	□	□	■	■
Watch variables	□	□	□	■	■
Low-level language interface	■	■	■	■	■
Toolkit available	Add-in	Included	Add-in	Add-in	Add-in
Model Building and Editing					
Offers true 3-D worksheets	■	■	■	■	■
User can create named associations of sheets	□	■	□	■	■
Includes group-edit mode	■	■	■	■	■
Allows file-linking formulas	■	■	■	■	■
External reference formula can use wildcards	■	□	□	■	■
Can freeze rows and columns as titles	■	■	■	■	■
User can hide rows/columns	□■	■■	□■	■■	■■
User can hide whole worksheets or windows	■	□	■	■	■
User can split screen horizontally or vertically	■	■	■	■	■
User can open two or more independently movable windows on a worksheet	■	□	□	□	■
N/A ② — Not applicable: The product does not have this feature.					

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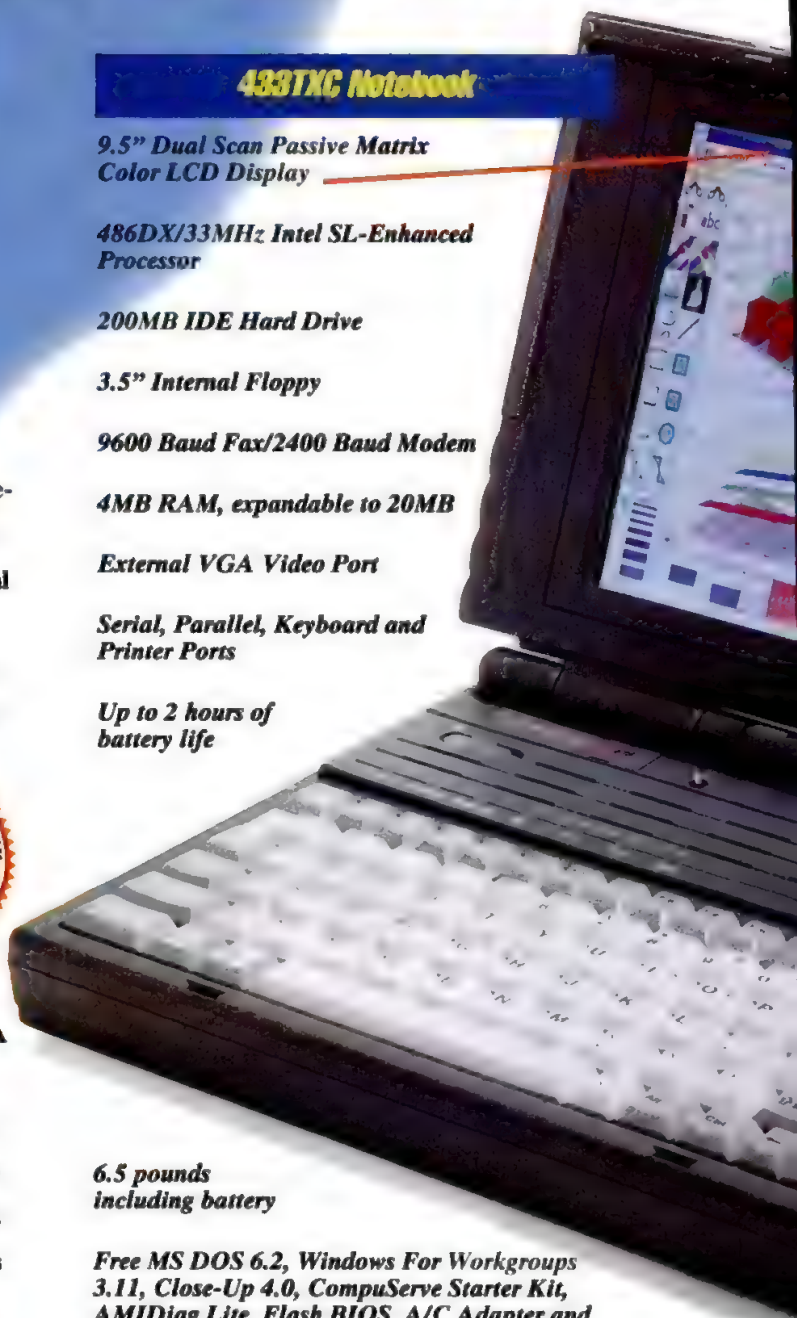
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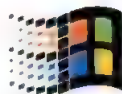
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425TX Notebook

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the link meaningless as soon as the source worksheet is rearranged). And client links that have become invalid because the source file has moved are marked only by ERR. (The program should present a

1-2-3 for Windows
*includes a set of customiz-
able SmartIcon palettes
that let you pick fonts
and formats from
convenient pop-up lists.*

File Open dialog box and let you repair the link.) Though the program has an excellent auditor, its error value does not differentiate among different kinds of errors.

Moreover, on our cut-and-paste test via the Windows Clipboard, 1-2-3 for Windows took so long that we thought our system had bitten the dust. (Representatives at Lotus Development say that the delay is caused by the fact that 1-2-3 for Windows recalculates upon executing the paste command, even in manual recalc mode, and they recommend the classic-menu /Move command, which bypasses the Clipboard.)

In these respects, 1-2-3 for Windows, Release 4.01, looks dim beside its competition. Next to its former self, the spreadsheet is a brilliant piece of work—perhaps brilliant enough. But in many ways it still clings awkwardly to its past.—C.S.

Borland International Inc.

Quattro Pro for DOS, Version 5.0

On the functionality-per-dollar scoreboard, the boss spreadsheet in the DOS world is clearly Quattro Pro for DOS, Version 5.0. Priced temporarily at \$49.95, this venerable and powerful program would also be the overall value pick were it not for the identically priced and far more powerful Quattro Pro for Windows, Version 5.0, Standard Edition.

► SUMMARY OF FEATURES

ENDS

PC MAGAZINE
EDITORS' CHOICE

Products listed in alphabetical order	Lotus 1-2-3 for DOS	Lotus 1-2-3 for OS/2	Lotus 1-2-3 for Windows	Quattro Pro for DOS	Quattro Pro for Windows, Workgroup Edition
■ = YES □ = NO					
Model Building and Editing (continued)					
Allows partial-row and partial-column insertions and deletions	□	■	■	■	■
Allows drag-and-drop copies and moves	□	□	■	□	■
Includes undo command	■	■	■	■	■
Includes command to repeat last action	□	□	□	□	□
Allows copying and pasting of formats only	■	■	■	■	■
Allows erasure of formats only	■	■	■	□	■
Automatic fill capability	□	□	■	□	■
User can set column width for widest entry	□	■	■	■	■
User can set row height for tallest entry	■	■	■	□	□
Includes outliner	□	□	□	□	□
User can create named scenarios	□	□	■	□	■
Includes spell-checker	□	□	■	□	■
Includes search-and-replace	■	■	■	■	■
Printing					
Includes print previewer	■	■	■	■	■
User can adjust margins	□	□	■	□	■
User can adjust column widths	□	□	■	□	□
Prints in background	■	■	■	■	■
Automatic page scaling	■	■	■	■	■
User can specify scaling factors	■	□	■	■	■
Supports multiline headers and footers	□	■	□	□	■
Worksheet range can be used as page heading	■	■	■	□	□
Can create libraries of named print settings	■	□	■	□	■
Can print with or without cell grid lines	■	■	■	□	■
Can print with or without worksheet frames	■	■	■	■	■
Prints in landscape mode	■	■	■	■	■
User can specify starting page number	■	■	■	■	■
Includes option to print formula text, with each cell on a separate line	■	■	■	■	■
Security					
Warns against file overwrite on save	■	■	■	■	■
Timed background backup option	□	□	■	□	□
Can create backup on save	■	■	■	■	■
Can hide/lock cell contents	■ ■	■ ■	■ ■	□ □	■ ■
Files can be password-protected	■	■	■	■	■
Other User Interface Features					
User can customize screen colors	■	■	■	■	■
User can display or suppress worksheet grid lines	■	■	■	■	■
Includes icons for common tasks	■	■	■	■	■
Customizable icon palettes	■	■	■	■	■
Movable icon palettes	□	■	■	□	□
Can display multiple palettes	□	□	□	□	■
User can create keyboard shortcuts for common commands without writing macros	□	□	□	■	□

Do You Make These Six Common Mistakes On Your Taxes?



Six common mistakes can cause you big headaches on your taxes. An oversight here, an omission there. From unnecessary tax payments to full blown IRS audits -- you can end up paying too much ... or worse.

But now, using TurboTax and your personal computer, you can avoid these simple but costly mistakes:

1 The Arithmetic Error

Today, even the simplest forms contain complex calculations. And with all the late-night scrambling, an innocent mistake could cost you plenty.

2 The Transcription Error

With all those numbers being juggled from schedule to schedule, it's no wonder the figures are so often transcribed incorrectly or entered on the wrong line.

3 The Omitted Form

Even "ordinary" returns require anywhere from six to a dozen forms to complete. It's easy to miss one ... or end up rushing all over town to find the one you need.

4 The Misinterpreted Instruction

At best, IRS instructions can be tough to understand. At worst they can be mind-boggling. What you need are clear directions in plain English.

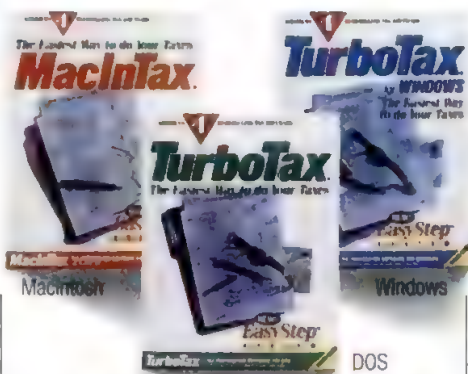
5 The Overlooked Deduction

You'd have to be a professional tax preparer to know all the deductions you're entitled to. If you miss just one, it could cost you hundreds of dollars.

6 The Exceeded Guideline

The fastest way to trigger an IRS audit is to exceed the "normal" range on one of your deductions. You need to know what the IRS looks for on a line-by-line basis.

When you do your taxes with TurboTax, mistakes like these are virtually impossible. And filing your taxes couldn't be easier.



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TurboTax is America's #1 best-selling tax software -- over seven million returns were filed with TurboTax last year! With TurboTax on your PC (or MacInTax on your Macintosh) and the award-winning EasyStep® tax preparation process, you can completely and accurately prepare your income taxes in just a few hours.

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Then TurboTax makes all the calculations, checks for accuracy and consistency, and transfers every number to the proper lines on the proper forms. And, TurboTax prints every form you need in IRS-approved format right on your own printer -- ready to sign and mail (or file electronically, if you prefer, for a faster refund).

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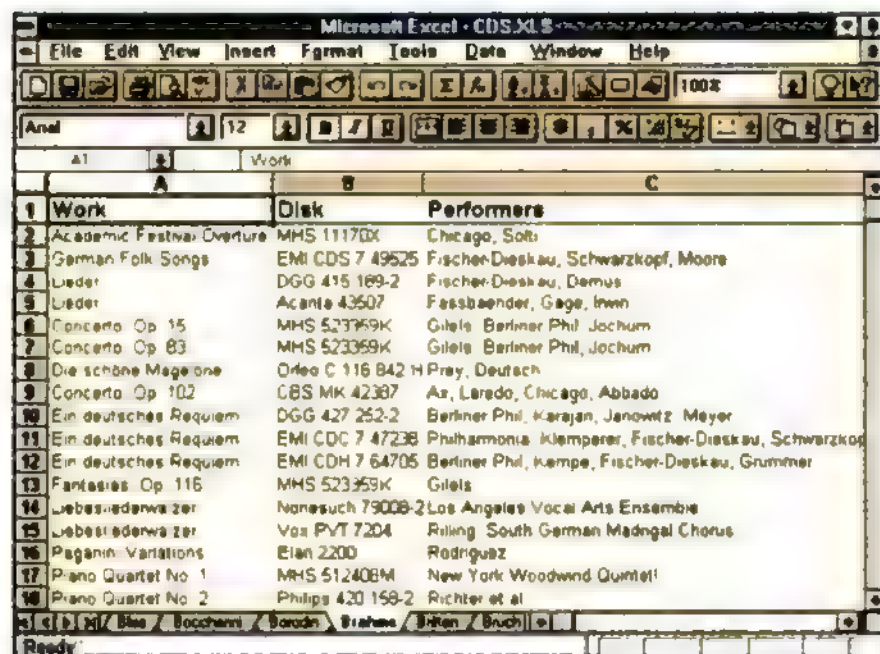
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▪ Waiting in the Wings: *Excel 5.0*

by Craig Stinson

Because Microsoft Excel for Windows, Version 5.0, was still in beta testing at press time, we were unable to give it a full review, evaluate its performance, or consider it as an Editors' Choice candidate. But here we offer a sampling of what you can expect to see when this product ships.

Excel 5.0 will offer Quattro Pro for Windows-style three-dimensionality, with nameable page tabs running along the bottom of its document windows. The multiple document file types of earlier versions will be replaced by a single .XLS file type, which may contain various kinds of pages—worksheets, charts, macro pages, and Visual Basic modules.



Work	Disk	Performers
Academic Festival Overture	MHS 11170X	Chicago, Solti
German Folk Songs	EMI CDS 7 49525	Fischer-Dieskau, Schwarzkopf, Moore
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Lieder	Acanis 43507	Fassbaender, Gage, Innn
Concerto Op. 15	MHS 523359K	Gilels, Berliner Phil. Jochum
Concerto Op. 83	MHS 523359K	Gilels, Berliner Phil. Jochum
Die schone Magelone	Orfeo C 116 842 H	Pray, Deutsch
Concerto Op. 102	CBS MK 42387	Az, Laredo, Chicago, Abbado
Ein deutsches Requiem	DGG 427 252-2	Berliner Phil. Karajan, Janowitz, Meyer
Ein deutsches Requiem	EMI CDC 7 47238	Philharmonia, Klempner, Fischer-Dieskau, Schwarzkopf
Ein deutsches Requiem	EMI CDH 7 64705	Berliner Phil. Klempe, Fischer-Dieskau, Grummer
Fantasies Op. 116	MHS 523359K	Gilels
Lebensliedererzer	Nonesuch 79008-2	Los Angeles Vocal Arts Ensemble
Lebensliedererzer	Vox PVT 7204	Rilling, South German Madrigal Chorus
Paganini Variations	Eian 2200	Rodriguez
Piano Quartet No. 1	MHS 512408M	New York Woodwind Quintet
Piano Quartet No. 2	Philips 420 158-2	Richter et al

Version 5.0 of Excel has adopted the notebook metaphor introduced in Quattro Pro for Windows 1.0.

DATABASE PROWESS

Excel 5.0 will provide vastly improved features for managing internal databases, or *lists* (to use the program's new terminology). You'll be able to work with multiple databases in the same file, and you won't have to use the Set Database command to make the query features accessible. Excel 5.0 will automatically recognize which lines of your list constitute field headings and will exclude them when you're ready to sort. The sort command will let you choose real field names instead of column

letters and will let you create custom sorting orders.

To simplify the query-and-extract process, Excel 5.0 will offer AutoFilter and Advanced Filter commands. You'll be able to specify which records you want to see by choosing field values from drop-down lists; the program will display the qualifying records in place by simply hiding the nonqualifying rows. Subtotaling commands will let you perform aggregate calculations on groups of records, and Excel 5.0 will automatically outline the subtotaled list so that you can switch between aggregate and detailed views with simple mouse clicks. The AutoSum command will automatically generate a grand total. (Noting the presence of

subtotals, AutoSum will tally up the subtotals and ignore everything else.)

For external queries, Excel 5.0 will shuck off the Q+E add-in, replacing it with a linked standalone application called Microsoft Query. A subset of Microsoft Access's database manager, Query will support any back end for which you have a full-compliance ODBC (open database connectivity) driver. In the initial release, Microsoft will ship

drivers for Access, Btrieve, dBASE, FoxPro, Oracle, Paradox, SQL Server, SyBASE, Text, and .XLS files. The .XLS drivers will allow you to use Query to get at certain records that are kept in server-based spreadsheet documents.

In response to Lotus Improv for Windows, Excel 5.0 (like Quattro Pro for Windows) will include a malleable cross-tabulating report generator. You will be able to drag field headings between row, column, and page axes to change the viewing angle on your

data. This feature, called the PivotTable Wizard, will be a substantial improvement over the Crosstab Report Wizard included in Microsoft Excel for Windows 4.0.

Like Microsoft Word for Windows, Version 6.0, Excel 5.0 will support OLE 2.0, allowing in-place editing of embedded objects and making its own features programmable via other applications that support OLE 2.0. Excel 5.0 will also be the first Excel version to offer Microsoft Visual Basic, Applications Edition, as its macro language. The original Excel macro language (now called the ".XLM language") will still be supported and will be expanded to include verbs for the program's new features. Subsequent versions of Excel will continue supporting but will not expand the .XLM language.

Excel 5.0's charting module will offer donut charts, error bars, and trendlines, along with some welcome simplification. The distinction between "attached" and "unattached" text will virtually disappear (you'll be able to reposition any titles or text annotations with the mouse), and a new "drag-and-plot" feature will let you expand an existing chart by dropping new data onto it.

FREE ADVICE

To help you learn Excel 5.0's myriad keyboard and mouse shortcuts, the new Tip Wizard will watch the way you work and make suggestions. If you ignore them, Tip Wizard will assume you like your way of doing things and refrain from annoying you.

Excel 5.0's menu bar, dialog boxes, and toolbars will all be redesigned for consistency across the entire Microsoft application product line. And as with Word for Windows, Excel 5.0's File menu will include commands for both saving summary information and finding files on disk. □

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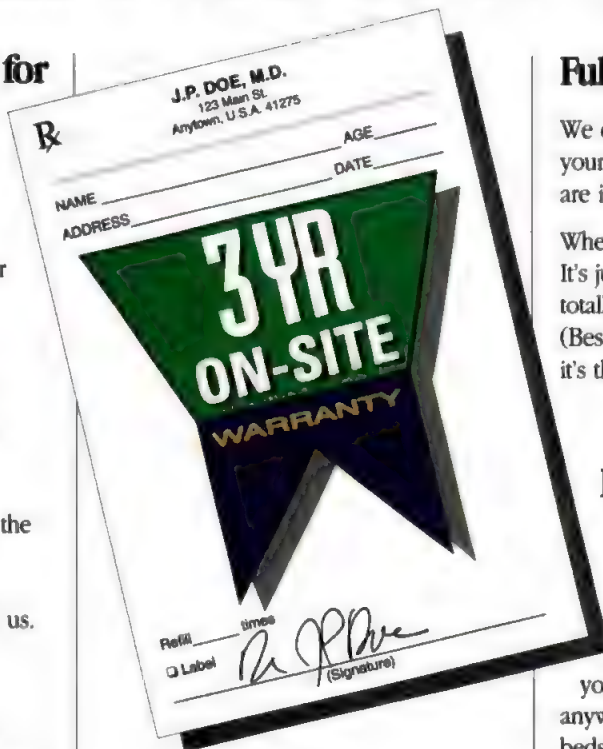
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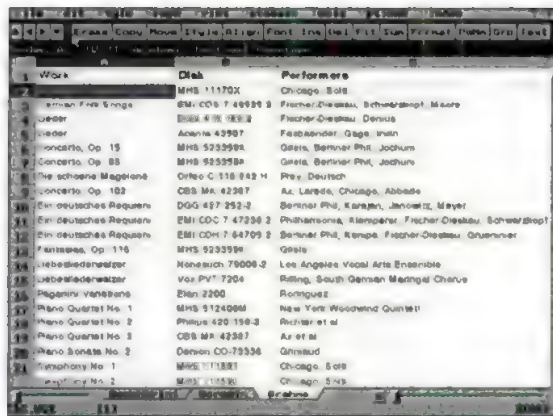
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Like Excel 5.0, Quattro Pro for DOS has also adopted the notebook metaphor of Quattro Pro for Windows.

In its latest upgrade, Borland retrofitted elements of the Quattro Pro for Windows notebook metaphor onto Quattro Pro for DOS, giving it true three-dimensionality with nameable worksheet pages. You can click on notebook tabs to move between pages or drag the tabs to reorganize your workbook. Furthermore, a handy Group mode lets you enter both content and styling into many pages at once, and you can now tally up pages as easily as rows or columns with the Speed-Sum button. In other respects, however, Quattro Pro 5.0 remains functionally identical to Quattro Pro for DOS, Version 4.0.

FACT FILE

Quattro Pro for DOS, Version 5.0

Borland International Inc., 1800 Green Hills Road, Scotts Valley, CA 95067; 800-331-0877, 408-431-8400; fax, 408-439-9119

List price: \$99.95 (special introductory price: \$49.95 [\$39.95 for current users] through January 15, 1994)

Requires: 512K RAM (640K recommended), 6MB hard disk space, DOS 2.1 or later.

In short: The DOS version of Quattro Pro, now a full-fledged 3D spreadsheet, offers a number of feature advantages over competing products, although it is slower to recalculate large worksheets and lacks Lotus 1-2-3 keystroke-macro compatibility. Its most enduring strength may be its ability to run on small-scale hardware.

444 ON READER SERVICE CARD

MEMORY ISSUES

While Lotus 1-2-3 for DOS, Release 3.4a, uses extended memory to handle large worksheets, Quattro Pro for DOS uses disk-based virtual memory. (It also supports expanded memory.) As a result, the program runs effectively with as little as 512K of memory and supports any XT-class machine or better. When working in large worksheets, however, you can expect the program's use of virtual and expanded memory to produce slower recalculation than you'd find in 1-2-3 for

DOS 3.4a.

Quattro Pro for DOS's other potential disadvantage relative to 1-2-3 for DOS 3.4a, is its inability to run keystroke macros designed for 1-2-3. Macro code that uses curly-bracket commands (such as {GETLABEL}) will run as well in Quattro Pro as in 1-2-3, but keystroke sequences created in 1-2-3 will need to be modified.

QUATTRO PLUSES

Other inducements for the DOS user to pick Quattro Pro include a slide-show facility (serviceable in a pinch but underpowered when compared with a dedicated graphics package), an integrated file manager, built-in support for Symantec's SQZ! file compressor, a built-in macro debugger, the ability to read and write dBASE and Paradox files without a translation step, support for Paradox Access. With this feature, you can run Quattro Pro from within Paradox for DOS (3.5 or later). Without even seeing the DOS prompt, you can load a Paradox table into a Quattro Pro notebook, work with the table in the spreadsheet, and return to Paradox in one keystroke.

Quattro Pro for DOS's implementation of three-dimensionality is also far more usable than 1-2-3's. (But Lotus has indicated that it too will offer a notebook-style interface in an upcoming DOS product.) And both its function library and macro language are modestly more powerful than those of 1-2-3.

Quattro Pro for DOS includes a unique and valuable set of analytical graphing commands that allow you to do

SUITABILITY TO TASK

Quattro Pro for DOS

	POWER	EASE
Analysis and model building	Fair	Fair
Charting	Good	Good
Worksheet presentation	Good	Good
Interoperability	Fair	Fair
Applications development	Excellent	Good
Workgroup support	N/A	N/A

such things as plot aggregated values (monthly totals for a series of daily inputs, for example), generate moving averages, and zoom in for closer looks at subsets of plotted data. (Some of this graphing functionality has now made its way into Quattro Pro for Windows, but none of it exists in other vendors' spreadsheets.) Moreover, Quattro Pro for DOS scored consistently higher in our charting, worksheet presentation, and application-development Suitability to Task categories than did Lotus 1-2-3 for DOS 3.4a.

For the DOS user with small-scale hardware, Quattro Pro's ability to run under 512K of memory may be its most durable advantage. Other users, provided they don't require full 1-2-3 macro compatibility, will find Quattro Pro a richer product than its principal DOS competitor.—C.S.

Borland International Inc.

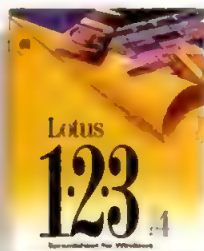
Quattro Pro for Windows, Version 5.0, Workgroup Edition

While this may indeed be the year of the notebook metaphor, with page-tabbed three-dimensional spreadsheets appearing (or about to appear) from all major vendors, no program yet exploits this idea as thoroughly or effectively as its originator: Quattro Pro for Windows. In the latest release, Quattro Pro for Windows, Version 5.0, worksheet pages may be named, moved via drag and drop, selected as formula arguments in point mode, and collected into named groups. And a right-click on a page tab lets you assign a variety of page-specific attributes—such as protection and gridline display—that

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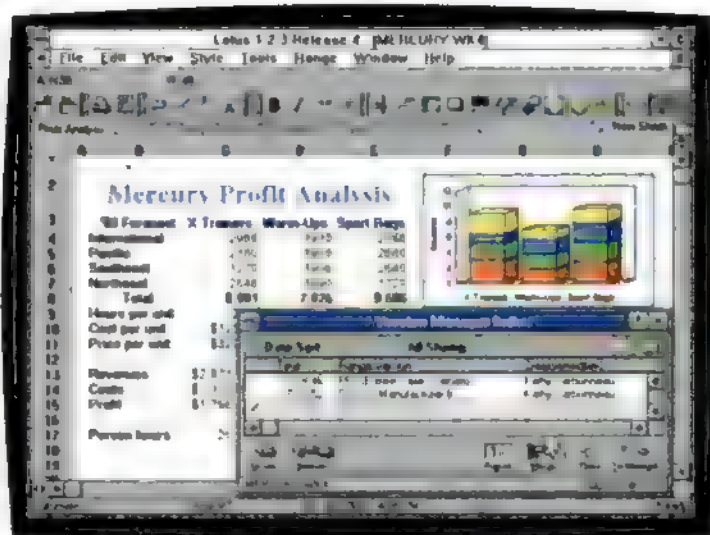
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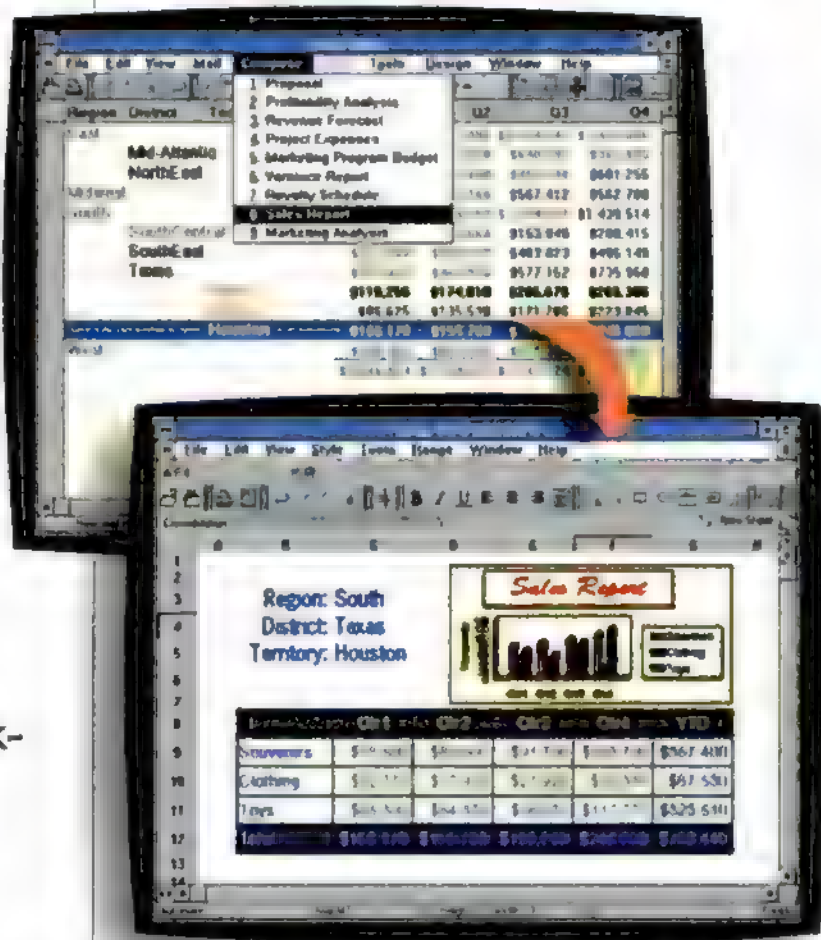
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To join the hundreds of thousands who are switching to Lotus 1-2-3 Release 4, call **1-800-TRADE UP, ext. 9329*** or visit your Lotus Authorized Reseller. It's not only easy to work with, it actually makes you easy to work with.

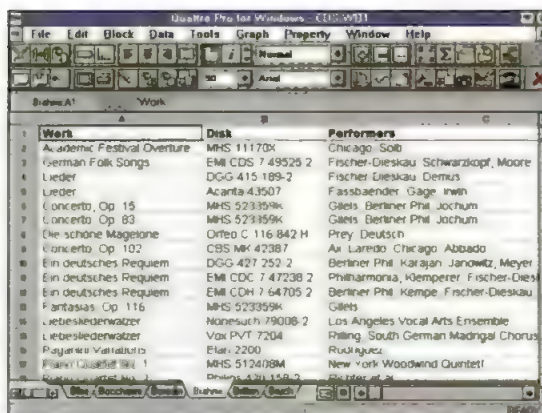
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are global defaults in other programs.

Borland introduced these ideas over a year ago with Quattro Pro for Windows, Version 1.0. In Version 5.0 (the product's first upgrade got a version-number boost to put it in step with its DOS counterpart), the company applied only modest tweaks to the UI, making commands and property settings accessible via right-clicking and giving users the option of coloring individual page tabs. But it added a great deal of analytic strength and some welcome learnability features.

In its continuing strategy of trading per-unit revenue for market-share gain, Borland recently established a temporary, special-offer price of \$49.95 for Quattro Pro for Windows, Standard Edition. Pricing after the expiration of this offer (on January 15) hasn't been announced. But the company also offers a "Workgroup Edition," at the standard spreadsheet list price of \$495. For the extra money, you get a spelling checker, tools to simplify network installation, and SQL connectivity. The Workgroup Edition also provides OBEX (object exchange), a self-contained publish-and-subscribe sys-



Pages in the Workgroup Edition of Quattro Pro for Windows can be named, and sets of pages can become named groups.

sage balloon, which politely disappears at your next keystroke. Macro programmers can easily add custom balloons to their applications.

The tutors, unlike similar facilities in other products, give users the option of working with their own data instead of with canned examples. The experts, which are comparable to Microsoft's wizards, also work with your own data. For example, while the Graph Expert steps you through the process of building a chart, it shows you the impact of your choices on your own numbers.

To strengthen the analytical power of Quattro Pro for Windows, Borland has nearly tripled the size of the program's function library, adding a whole raft of specialized engineering, financial, and date-and-time functions. Like Excel for Windows, Version 4.0, Quattro Pro for Windows also now includes a suite of commands for such things as descriptive statistics, ANOVA, moving averages, exponential smoothing, histograms, and rank-and-percentile analysis. Along with these new functions and commands, Quattro Pro for Windows now supports array formulas, which can compress a great deal of data into a single formula, thus saving memory and enhancing the clarity of your modeling logic.

NATURAL NAMING

Quattro Pro for Windows now automatically creates intersection-based cell names. A simple menu command, for example, will assign the name "April_COGS" to the cell at which the column headed "April" and the row

named "COGS" intersect.

The analytical graphing features of Quattro Pro for DOS have now made it into Quattro Pro for Windows, providing users with tools for aggregating chart data, plotting moving averages, and generating "best-fit" regression lines. The handy zoom-and-pan remains a DOS-only feature, however, and the new "donut" charts in Quattro Pro for Windows are nothing more than pies with holes in their centers. Unlike donut charts in the forthcoming Excel for Windows, Version 5.0, they

do not accommodate multiple data series.

To assist with adding, deleting, and finding on-sheet database records, Quattro Pro for Windows 5.0 includes a Form command, modeled after a similar feature in Excel. Unlike 1-2-3 for Windows, however, Quattro Pro for Windows has not modernized its approach to constructing internal database queries; Borland lags behind its competition in this area.

IMPROV-IZED MODEL

To help you make sense of flat-file spreadsheet databases, though, Quattro Pro for Windows now offers the Data Modeling Desktop, a separate DDE-linked application that lets you convert

SUITABILITY TO TASK		
Quattro Pro for Windows, Workgroup Edition		
	POWER	EASE
Analysis and model building	Excellent	Excellent
Charting	Excellent	Excellent
Worksheet presentation	Excellent	Excellent
Interoperability	Excellent	Excellent
Applications development	Excellent	Excellent
Workgroup support	Excellent	Good

tem for exchanging documents with fellow workers. The Workgroup Edition was tested for this review.

LEARN BY DOING

New learning aids for Quattro Pro for Windows include a form of balloon help (ObjectHelp), a set of computer-based training lessons (Interactive Tutors), and a panel of "Experts" to assist with the program's more advanced features. You can select nearly any object on the landscape (an icon-palette button, for example) by right-clicking and hitting the Ctrl key at the same time. This will bring up a mes-

FACT FILE

EDITORS' CHOICE

Quattro Pro for Windows, Version 5.0, Workgroup Edition

Borland International Inc., 1800 Green Hills Road, Scotts Valley, CA 95067; 800-331-0877, 408-431-8400; fax, 408-439-9199

List price: \$495 (upgrade price, \$99)

Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or Windows for Workgroups.

In short: Quattro Pro for Windows' notebook-style three-dimensionality gets top marks for usability. The latest version has closed the analytic-feature gap with Excel, and the Workgroup Edition offers OBEX, a self-contained publish-and-subscribe system for workgroup connectivity.

ON READER SERVICE CARD

inscrutable flat data into meaningful two-dimensional crosstabs. The resulting tables (see the sidebar "Spreadsheets: Added Dimensions") bear a superficial resemblance to worksheets in Lotus Improv, because they let you change your angle of view by dragging field headings from one table axis to another. When you're satisfied with your table, you can return it to the Quattro Pro for Windows worksheet, either as a block of static data or with DDE links in place.

Other important new tools include a consolidator and a scenario manager. The consolidator rolls up ranges based on their row and column labels, whether or not the ranges share a common layout. The scenario manager, like that of 1-2-3 for Windows, Release 4.01, and unlike that of Excel 4.0, allows multiple scenario sets per file. It also makes effective use of color to highlight cells that have changed and cells affected by changing cells. Unlike 1-2-3 for Windows' Version Manager, however, it does not automatically record the name of the person contributing each scenario.

The Workgroup Desktop, included with only the \$495 Workgroup Edition of Quattro Pro for Windows, offers a Macintosh-like publish-and-subscribe system for exchanging selected ranges, individual pages, or whole worksheets with fellow workers. Documents can be transported via any of five methods—MAPI, MHS, VIM, MCI Mail, or your local area network—and published to any desired "revision depth." If you choose a revision depth of three, for example, your recipients will always have the latest version plus the two most recent earlier versions. As an additional aid to document sharing, Quattro Pro for Windows now supports OLE 1.0 in both client and server modes.

BETTING CENTERED

Miscellaneous other improvements: Quattro Pro for Windows now lets you center headings automatically over a

specified range of columns. Single cells can now be dragged and dropped, just as ranges and pages can. You can add your own custom label sequences to the list recognized by Quattro Pro for Windows' "SpeedFill" command. And the Import command now accommodates tab-delimited files. An optional noninteractive "parse expert" can also be turned loose

on undelimited text files. Most of the time, this creature will turn your long labels into appropriate columns, saving you the trouble of doing the parsing by hand.

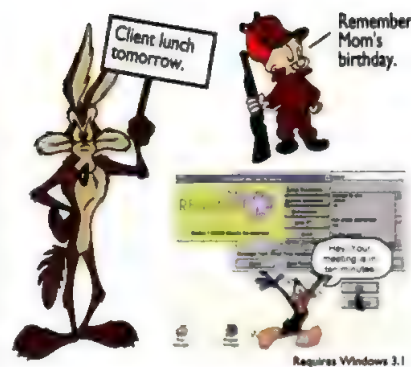
One important feature that still hasn't been brought over from Borland's Pro for DOS spreadsheet is the auditor.

Quattro Pro for Windows includes commands for tracking down the sources of ERR and NA values, and for tracking down the sources of circular references, but it provides no other means of tracking through a chain of formula dependencies. Borland has promised to redress this shortcoming in a future version of the spreadsheet.

A more serious problem is that Quattro Pro for Windows turned in weak performances on all of our recalculation tests. These tests showed 1-2-3 for Windows to be nearly twice as fast at working through a heavily formula-laden worksheet. A formula compiler included in the Borland product offers only a partial remedy. It purportedly improves recalc speed on certain kinds of spreadsheets, but, in informal testing at PC Magazine Labs, we were unable to detect significant improvements.

If its recalc speed (or lack thereof) doesn't deter you and you don't require full Lotus macro compatibility (Borland has deleted its 1-2-3 keystroke reader to comply with a recent court ruling), the Standard Edition of Quattro Pro for Windows is a value not to be found anywhere else in the spreadsheet market. At the high end, the Workgroup Edition of Quattro Pro for Windows more than holds its own against formidable competition.—C.S. □

New learning aids for Quattro Pro for Windows include a form of balloon help, a set of computer-based training lessons, and a panel of "Experts."



Requires Windows 3.1

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MAINSTREAM MICE



The Evolving Mouse

by James Karney

In the early days of the PC, when virtually everyone worked under the text-only umbrella of DOS, a keyboard was the only input device most users needed. Mice first gained widespread acceptance alongside the Macintosh, and they migrated to the PC-compatible marketplace primarily for graphics applications such as desktop publishing.

Today, graphical user interfaces (GUIs) are the norm, and a pointing device—usually a mouse—is an indispensable part of most systems. Mice are used for everything from Windows word processors and spreadsheets to high-end CAD and graphics applications. This proliferation has brought new diversity of features, drivers, and design.

The GUI has done more for the popularity of the mouse than Walt Disney. Many of these 14 mice feature improved ergonomic design and drivers that you can customize to suit your work habits.

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The Evolving Mouse

THE ECONOMICS OF ERGONOMICS

One of the most-touted features of the newer mice on the market is their improved ergonomics. (Microsoft, for one, says it spent \$10 million developing the radical J-shaped design of its new mouse.) The repetitive hand and finger motion that mice engender may contribute to carpal tunnel syndrome, as well as repetitive stress injuries such as tendonitis. These painful, long-term problems can keep employees off the payroll or even lead to surgery.

Dr. Bryce Rutter, a kinesiologist and industrial designer with Metaphase Design Group in St. Louis, Missouri, says that well-designed mice can reduce the risk of such injuries and improve productivity. Ideally, he says, a mouse's case should be sculpted to fit your palm, with no abrupt edges that dig into your fingers. The mouse should be large enough to support the weight of your entire hand, and specifically should support the metacarpal ridge where the fingers meet the palm. Senior ergonomist Edie Adams, M.E. Des., of the Joyce Institute in Seattle, Washington, concurs, and emphasizes that the mouse should let you keep your wrist and shoulders in neutral, unflexed positions. You should not have to grip the case tightly to keep the mouse under control.

Of course, you should also find a mouse that is comfortable for your individual build. To acquire a variety of subjective viewpoints in this regard, we selected a test team that included men, women, and a three-year-old child; individuals with small, medium, and large hands; and both left- and right-handed users. All testers used the mice with Microsoft Word for Windows, Microsoft Excel, CorelDRAW, and ImagePals Enhancer for several days. Except for the child, each tester kept a written log of likes and dislikes. We discuss the results of these subjective evaluations in the individual reviews and in our Editors' Choice box.

MEASURING MOTION

Mice can sense motion using optical or mechanical techniques, or—most common—a combination of the two. The purely optical variety contain LEDs (light-emitting diodes) that reflect light

off a special mouse pad printed with a fine patchwork of horizontal and vertical lines. Receptor transistors note the pattern of reflections and use that information to measure distance. Because no moving parts are involved in the sensing process, optical mice are the most reliable type; their primary drawback is that they require the special pad. Among the reviewed models, Mouse Systems Corp.'s PC Mouse, PC Mouse III, and PC Mouse 3D are purely optical units.

Mechanical mice generally use a rubber or rubber-coated ball. As the mouse moves, the rotation of the ball is transmitted to a pair of perpendicular rollers. Attached to these rollers are wheels with metal contacts. As the wheels spin, the contacts periodically touch tiny wire brushes inside the mouse, completing a circuit. While this design is inexpensive, it is less accurate than others and prone to problems with dirt, dust, and weak parts. None of the tested mice are purely mechanical.

The majority of today's mice

are optical-mechanical. Optical-mechanical mice use the same ball-and-roller design as mechanical mice, except that the rollers are attached to slotted wheels. As they spin, the wheels alternately block and transmit light produced by an LED, and these transitions are sensed by light-sensitive semiconductors.

Optical-mechanical mice can be used on any surface, though their delicate moving parts, balls, and rollers tend to pick up dirt and grime. The reviewed mice from Appoint, Key Tronic, Logitech, and Microsoft are all optical-mechanical, as are Mouse System Corp.'s New Mouse, OmniMouse II, and White Mouse models.

RESOLUTION

Mice also vary in their resolution. Reported in dots per inch (dpi), resolution is a measure of how many motion signals are recorded when the mouse travels a given distance. The first PC mice were 100-dpi devices; today, most of them range from 300 to 400 dpi.



EDITORS' CHOICE

• A matter of personal preference

A mouse is a critical link between you and your computer, and choosing one can be a decision as personal as selecting Windows wallpaper. Though many of the mice we tested claim ergonomically inspired designs, none is appropriate for every user. For right-

handed adults working in mainstream applications, nearly any of the reviewed mice would suffice; the best way to choose one is to try each for yourself. We didn't feel that any product stood out enough to deserve an Editors' Choice. Still, we found a number of models that offered likable features.

The \$109 Microsoft Mouse, Version 2.0, represents a dramatic improvement over the original design, with far better glide and clicking response, plus much-improved drivers. Our right-handed testers with average- or large-size hands found that the Microsoft Mouse was extremely com-

fortable after they had become accustomed to its unusual J-shaped design. Left-handed and small-handed users were less satisfied.

Logitech's MouseMan Left (\$109) was the mouse of choice for our left-handed tester. We found the MouseMan Cordless (\$149) useful in environments where the mouse cord would be a nuisance, although the design is somewhat unwieldy because it must incorporate a 3-volt battery and a radio transmitter.

If you're looking for a mouse to use at home, consider Logitech's Kidz Mouse. This \$59 product actually resembles a real mouse, and is designed

The Evolving Mouse

Resolution is a fixed factor, but most mouse drivers allow you to set ballistic tracking, a term used in the industry to describe how the driver translates movements of the mouse into motion of the pointer on the screen. By moving the mouse slowly, you can control the cursor with precision; as you move the mouse more quickly, the cursor's rate of travel increases.

With this flexibility, higher resolution becomes less of a concern. However, if you require extremely precise pointer control, you may be better off with a digitizing tablet.

INSTALLATION

Today, most mice are available with either a serial connector that can be attached to any free COM port or with a 6-pin DIN connector that fits into a dedicated PS/2-style mouse port. If your system provides a PS/2 mouse port, go with a PS/2 mouse and leave your serial ports free for other devices. With an inexpensive adapter you

to fit children's small hands. It even lets you keep another mouse simultaneously connected to the PC.

The \$380 PC Mouse 3D, from Mouse Systems Corp., is the hands-down winner in the features arena. Its controls include five buttons and a roller—perfect for CAD manipulation—and its drivers let you program the mouse buttons to send keystrokes to any application. But the PC Mouse 3D is overkill for mainstream use, and it requires a proprietary serial interface card to achieve its full potential.

If you want a mouse that you can use both on the desk and on the road, Appoint's \$119 Gulliver is the right product. This small wedge-shaped mouse has a short, 3-foot cord that won't get tangled around your laptop, and it comes with a 6-foot extension that gives you plenty of range on the desktop. The Gulliver's driver lets you flip the mouse upside-down for use as a trackball. Its small size, however, is unwieldy for large-handed users.

THE MOUSE THAT COMES WITH THE SYSTEM
This table shows which mice are bundled with the desktop systems sold by the top ten PC vendors. Vendor rankings were provided by CI InfoCorp and are based on DOS-based desktop systems sold in the United States to end users in 1993.

Rank	PC vendor	PC product line	Bundled mouse	Number of buttons
1	IBM Personal Computer Co.	IBM PS/1 IBM PS/2 IBM ValuePoint	IBM mouse manufactured by Logitech IBM mouse (manufacturer not specified) IBM mouse manufactured by Logitech	2 2 2
2	Compaq Computer Corp.	All desktops	Compaq mouse manufactured by Logitech	2
3	Packard Bell Electronics Inc.	All desktops	Packard Bell mouse	2
4	Dell Computer Corp.	All desktops	Dell mouse manufactured by Logitech	3
5	Gateway 2000	All desktops	Microsoft Mouse, Version 2.0	2
6	AST Research Inc.	AST Advantage! AST Bravo AST Promina	AST mouse manufactured by Logitech Microsoft Mouse (Bravo LC comes with AST mouse manufactured by Logitech) Microsoft Mouse	2 2 2
7	Acer America Corp.	All desktops	Acer mouse manufactured by Logitech	2
8	NEC Technologies Inc.	All desktops	NEC mouse manufactured by Logitech	2
9	Epson America Inc.	Epson Endeavor (Epson Direct) Epson Equity 4	Choice of Epson mouse manufactured by Logitech or Microsoft Mouse, Version 2.0 Epson mouse manufactured by Logitech	2 2
10	Digital Equipment Corp.	All Desktops	Digital mouse manufactured by Logitech	2

can convert a serial mouse into a PS/2-style mouse and vice versa.

Logitech's MouseMan Right and the Microsoft Mouse, Version 2.0, are also available as bus mice, meaning that each one of them connects to the PC through an ISA-bus card. Bus mice require somewhat more effort to install, but the advantage is that you get wider control of interrupt request line (IRQ) assignments.

Just about any mouse will function with Version 8.2 of Microsoft's mouse driver, which ships with Microsoft Windows 3.1. More expensive mice, including the Microsoft Mouse, Version 2.0, often come with their own more capable drivers. The best will allow you to set ballistic response, automatically snap the cursor to default buttons in dialog boxes, or even map mouse clicks to application commands with macros.

The two buttons most mice provide are adequate for typical uses, although nearly all of the products in this roundup provide three.

ABOUT THE PRODUCTS

Mice are sometimes bundled with new systems under a different brand name. The table "The Mouse That Comes with the System" indicates which

mice the top ten PC vendors include; Logitech models were the most popular.

In the capsule reviews that follow, we discuss 14 products from 5 different vendors and our experiences using them. Many of these mice are more expensive than generic products. By spending more than the \$50 or so that stripped-down units command, you can get better motion-sensing mechanisms, superior drivers, and innovative designs.

APPOINT

• Gulliver

For compact size and operation at any orientation, it's hard to beat Appoint's \$119 Gulliver. Appoint likes to design pointing



Appoint Gulliver

devices shaped like writing tools: Its first product, (the MousePen) resembled a pen, and the Gulliver has the same wedge shape and size as an artist's eraser. The 700-dpi Gulliver works like a normal mouse, but you slide it using only three fingers rather than your whole hand. Its diminutive size

suits Gulliver well for portable use, and the included driver even lets you flip the Gulliver over to use it like a trackball.

Our Contributors: JAMES KARNEY is a frequent contributor to *PC Magazine*. LEON ERLANGER was the associate editor in charge of this story.

(Gulliver is also compatible with Microsoft mouse drivers.) Large-handed users might find the Gulliver somewhat difficult to operate, because its small size may cramp their fingers.

Gulliver's main button is on its leading edge, and is easy to use. The second button is placed further back on the body in an awkward location that forces you to retract your finger as you are pressing down. A small third button allows you to shift the unit's tracking sensitivity on the fly.

Gulliver's standard cable is 3 feet long and connects to a PS/2-style mouse port. A 6-foot extension is included, as is an adapter to connect the unit to a serial port. A cordless version of Gulliver is in the works, but a production-level sample was not available for review.

►FACT FILE

Gulliver

Appoint, 4473 Willow Rd., #110, Pleasanton, CA 94566; 800-448-1184, 510-463-3003; fax, 510-463-3204.

List price: \$119.

Circle 446 on reader service card

KEYTRONIC CORP.

• Honeywell Mouse

The \$79 Honeywell Mouse (originally designed by Honeywell and now sold by Key Tronic Corp.) employs a new variation on the familiar optical-mechanical design. Instead of the usual ball, this mouse has two disks on its underside. Each disk has a beveled edge and is angled so that it rotates when the unit is moved; one disk registers horizontal motion, the other registers vertical motion. Key Tronic claims that the unit can be used on any surface—regardless of orientation—and that it tracks accurately without the skips or jumps that most mice encounter when their rollers become dirty.



Honeywell Mouse

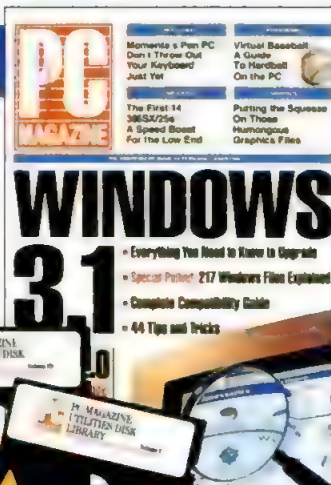
We found these claims to be valid; we were even able to use the mouse upside down underneath a desktop.

The Honeywell Mouse operates at 320-dpi resolution. It is available in two- and three-button 9-pin serial versions, or with a PS/2-style connector (\$79 each). It is compatible with the standard Microsoft mouse driver for Windows and also ships with its own DOS and Windows drivers.

Unfortunately, the Honeywell Mouse has a rectangular shape rather than the smooth curved shape of the competing products. The button placement felt awkward to most of our testers; the second button in particular seemed poorly fitted to the shape of the palm. The buttons also had a stiff response that demanded a bit more attention than those of the other reviewed products. The short, 4.5-foot cord limits motion when the mouse is used with a floor-standing tower PC.

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The Evolving Mouse

The Honeywell Mouse lacks the sophisticated drivers and inspired design that some of its competitors offer, but its reliable tracking mechanism and lifetime warranty are points in its favor.

►FACT FILE

Honeywell Mouse

Key Tronic Corp., P.O. Box 14687, Spokane, WA 99214; 800-262-6006, 509-928-8000; fax, 509-927-5383.

List price: \$79.

Circle 447 on reader service card

LOGITECH INC.

- First Mouse
- Kidz Mouse
- MouseMan Cordless
- MouseMan Left
- MouseMan Right

Logitech's line of mice includes something for everyone. The MouseMan Left and MouseMan Right, each \$109, include superb drivers with plenty of customization options. The \$149 MouseMan Cordless frees the mouse from its connecting cable. The \$79 First Mouse is targeted toward first-time users, and the \$59 Kidz Mouse works wonderfully to get children excited about computers.

All five of these mice provide full Microsoft Mouse compatibility. The Kidz Mouse has only 200-dpi resolution, but the others offer 400-dpi.

The three MouseMan products share the same three-button design and features. Each is shipped as a serial mouse that can also be connected to a PS/2 port with a provided adapter. (The MouseMan Right is also available as a bus mouse.) The MouseMan Left and MouseMan Right are mirror images, with rounded cases that slope down on one side. With the appropriate right- or left-hand version, the fit to both medium and large hands felt comfortable. Using the opposite-hand version proved tiring and made precise control and clicking difficult.

The \$149 radio-operated MouseMan Cordless is teardrop shaped, tapering off to the back. Unlike the other MouseMan products, this unit has its ball to the left side to leave room for the 3-volt battery that powers the transmitter. The receiver, about the size of a deck of cards, attaches to the PC via a serial or PS/2 mouse port.

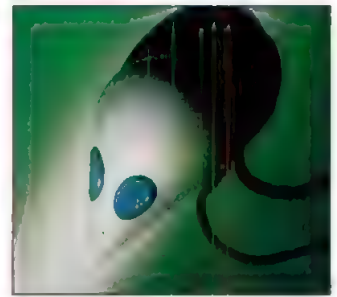
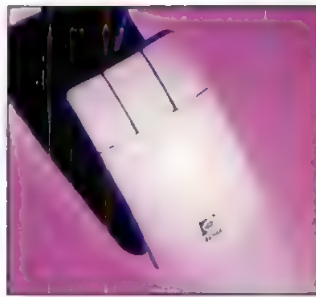
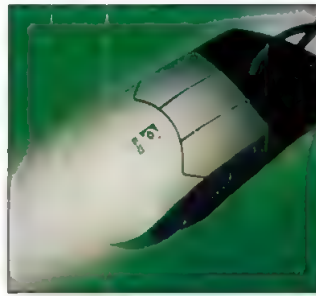
You can transmit on one of four radio frequencies, so it's possible to use more than one MouseMan Cordless in the same area. Even with the receiver hidden behind the monitor or inside a desk drawer, the MouseMan Cordless worked flawlessly. But we found it caused fatigue after a half hour of heavy use, because of the extra weight and bulk of the battery. For general Windows use, the freedom of movement you get by eliminating the cord is welcome, but for intensive use the MouseMan Cordless is less desirable.

The MouseMan series' drivers let you assign standard Windows command sequences to the middle and right mouse buttons. The drivers also offer a "smart cursor" feature that places the cursor on the default button for dialog boxes.

Logitech's three-button First Mouse lacks the fancy design of the MouseMan, has a slightly shorter, 6-foot cord, and comes with less-sophisticated driver software. (The driver software does let you set the middle or right mouse button to emulate a double-click of the left button, a potentially useful feature for novices unaccustomed to double-clicking.)

Logitech's Kidz Mouse is a unique product that's great for children. Shaped a bit like a live mouse, the \$59 Kidz Mouse has two buttons that look like ears, a tail that wraps around from the back, and two little bumps ("eyes") in the front. The design is symmetrical, and is equally suited for either right- or left-handed users. The Kidz Mouse comes only in a serial version with a 7-foot cord, but it's designed to allow operation even with another mouse installed on the PC.

Several 3- and 4-year olds found the Kidz Mouse much easier to operate than adult-scale products, and expressed delight over the cartoonish body. Adult observers noted that the children were more



Clockwise from top left: Logitech MouseMan Left, MouseMan Cordless, Kidz Mouse, and First Mouse.

accurate with it and did not have to adjust hand placement to click or drag. Drivers for the Kidz Mouse were fully compatible with a wide variety of software.

►FACT FILE

First Mouse
Kidz Mouse
MouseMan Cordless
MouseMan Left
MouseMan Right

Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901.

List price: First Mouse, \$79; Kidz Mouse, \$59; MouseMan Cordless, \$149; MouseMan Left, \$109; MouseMan Right, \$109.

Circle 448 on reader service card

MICROSOFT CORP.

• Microsoft Mouse, Version 2.0

The Microsoft Mouse, Version 2.0, has a larger case than its predecessor, and a J-shaped, gently curved design that Microsoft Corp. claims is the result of a \$10 million expenditure and two years in ergonomic and user testing. The new design feels a bit oversized at first, but with practice the fit seems very natural. After a few days, the Microsoft Mouse 2.0 was a fa-

The Evolving Mouse

favorite among all but our small-handed and left-handed testers.

The new mouse's clicking response is definitely superior to that of the earlier version: Pressing at any angle, any place on a button, produces a clean click and solid response. Another key improvement is the redesign of the Teflon feet, resulting in smoother travel.

The 400-dpi Microsoft Mouse 2.0 comes with a 6.5-foot cable. You can choose a model with a PS/2-style interface (\$109), a serial interface (also \$109), or both (\$125). A bus model is available for \$125.

Microsoft's new mouse driver for Windows, Version 9.0, is included with each variant of the Microsoft Mouse 2.0. The new driver lets you select pointer size, color, and trails. It also offers conveniences including zoom views, automatic snap-to-default-button, and orientation adjustment. Microsoft claims this new driver will work with any Microsoft-compatible mouse. Users of the original Microsoft Mouse can get the new driver directly from Microsoft for \$19.95 by calling 800-426-9400.

►FACT FILE

Microsoft Mouse, Version 2.0
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080; fax, 206-936-7329.
List price: PS/2 model or serial port model, \$109; PS/2 and serial port model, \$125; bus model, \$125.

Circle 449 on reader service card

MOUSE SYSTEMS CORP.

- New Mouse
- White Mouse
- OmniMouse II
- PC Mouse
- PC Mouse III
- PC Mouse 3D

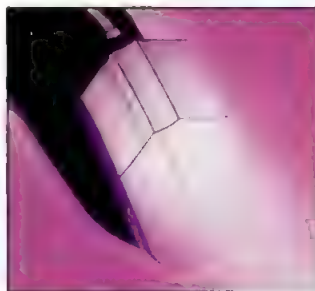
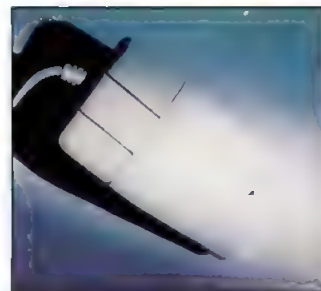
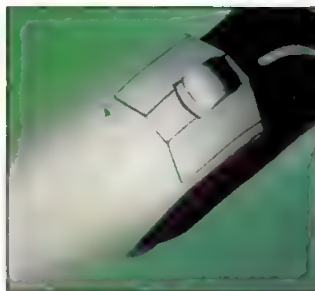
Mouse Systems Corp. lacks the name recognition of Logitech or Microsoft, perhaps because its sophisticated PC Mouse 3D (\$380) is geared toward CAD rather than mainstream business applications. Mouse Systems also sells a variety of other mice, including the optical-mechan-

ical NewMouse (\$75) and OmniMouse II (\$44), and the optical PC Mouse (\$77) and PC Mouse III (\$97). The \$46 optical-mechanical White Mouse is a sluggish unit with minimal features, best for novice or infrequent users looking for a bargain.

The PC Mouse 3D, with its 600-dpi resolution, three buttons, and unconventional roller, is a power user's dream. The mouse is ideally suited for CAD: By spinning the roller in combination with the two side buttons, you can rotate objects and move the cursor in three dimensions. Most software cannot take advantage of all the PC Mouse 3D's capabilities, but drivers are provided for AutoCAD releases 10, 11, and 12. (You also have to use a special serial card, included with the mouse.) The Windows drivers provide good speed and acceleration controls, and also let you program button-press and roller-motion combinations to a variety of command sequences.

We found the ergonomics of the PC Mouse 3D above average, allowing us to use the mouse with either hand for prolonged periods. The palm fit is very good for an average-size hand, and the roller is comfortably positioned where you would normally find a middle button. The two supplemental buttons are placed on the left side. This was a drawback for southpaws, because these two buttons were out of easy reach of the thumb.

The NewMouse is a 400-dpi, three-button, optical-mechanical mouse that looks like the PC Mouse 3D stripped of its roller and extra buttons. While it doesn't have the 3D's range of options and controls, its drivers offer excellent speed and acceleration adjustments.



Pictured at top left: Mouse Systems' PC Mouse 3D. Shown at top right is the company's PC Mouse, and at bottom left, the New Mouse. The PC Mouse 3D comes with five buttons and a roller that can be used to rotate objects and move the cursor in three dimensions.

The \$44 OmniMouse II is a bare-bones 350-dpi unit with two buttons. It offers almost no performance controls and moves very heavily. Its appeal would likely be strongest for new mouse users, since its slow response keeps the cursor under control.

The \$77 PC Mouse and \$97 PC Mouse III are both 300-dpi optical mice with three buttons; each can be connected to a serial port. According to the company, the PC Mouse is an economy model not compatible with the Microsoft Mouse that can be used in Windows only with Mouse Systems' proprietary driver. The \$46 White Mouse is a 350-dpi, 3-button optical-mechanical mouse that supports both serial and PS/2 interfaces. All three of these mice share the same case design, which was comfortable for all but large-handed users. If you want a no-frills, low-cost mouse, any of these three is suitable. □

►FACT FILE

NewMouse
OmniMouse II
PC Mouse
PC Mouse III
PC Mouse 3D
White Mouse
Mouse Systems Corp., 47505 Seabridge Dr., Fremont, CA 94538; 510-656-1117; fax, 510-770-1924.

List price: NewMouse, \$75; OmniMouse II, \$44; PC Mouse, \$77; PC Mouse III, \$97; PC Mouse 3D, \$380; White Mouse, \$46.

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Operating System	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS
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The war between VHS and BetaMax may be won, but the battle between Fast Ethernet and 100VG is just heating up.

by Tony Pompili

Users are demanding more bandwidth, new applications are consuming more bandwidth, and network administrators are wishing for more bandwidth. But who can afford to declare hundreds of thousands of dollars worth of existing bandwidth-limited cabling obsolete?

Two competing groups of large and powerful vendors advocating new 100-Mbps Ethernet architectures, 100VG-AnyLAN and 100BaseX, claim that managers of Ethernet networks won't have to toss out their cabling when they upgrade to high-speed networking. For the most part, they're right. But before you rip out your PC adapters and budget for 100-Mbps hubs, you might let the competitors butt heads, for it's VHS and BetaMax all over again.

The need for faster networks is real. As the demand grows for interaction between

fast client computers and even faster servers, the consolidated load of traffic can make the backbone into a bottleneck. Desktop computers equipped with high-speed internal bus technology and Pentium processors have the potential to produce 60- to 70-Mbps bursts of throughput, while applications like video and sound raise the sustained average level of demand for throughput to new heights. Combine that with the alarming rate at which graphics files are growing in size

from kilobytes to multimegabytes, and mundane tasks such as backing up servers can turn into all-night marathons. The answer is clear: Networks must get faster.

Right now, other than choosing a proprietary solution, network managers have three choices for higher bandwidth: Switched Ethernet, FDDI, and ATM. Switched Ethernet offers an incremental performance improvement by dedicating an Ethernet connection to each PC. These connections are then linked through a high-speed switch. FDDI, on the other hand, can increase performance drastically by raising the line speeds from 10 Mbps to 100 Mbps. And now with FDDI running over copper, its price tag has dropped and is now more attractive than ever. Asynchronous transfer mode (ATM) combines switching and increased line speed for even faster speeds across LANs and WANs.

Most experts believe that in five to ten

► NETWORK EDITION INDEX

First Looks

NAT NMS/100, Version 2.12
for Windows/
NAT LANB450
Remote EtherMeter
RMON.....NE15
IBM EtherStreamer
32 MC.....NE15
netViz.....NE25
XCd XJet IV.....NE26

Thomas-Conrad
TC4047 Token-Ring
EISA Adapter.....NE28
New & Improved
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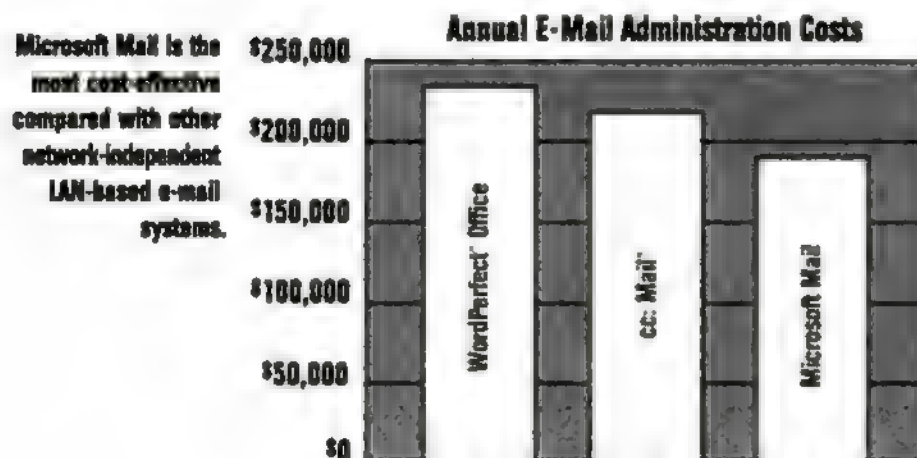
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Microsoft

years ATM will dominate the industry, but deploying ATM today is far too expensive for many companies. Even FDDI represents a major investment for a company whose network is already built around Ethernet. And while Switched Ethernet is available today, it lacks the bandwidth of FDDI or ATM (see "ATM: The Emperor's New Clothes" in *PC Magazine: Network Edition*, December 21, 1993)

The window of opportunity, then, is wide open for a networking scheme that can provide speed faster than 10 Mbps of dedicated bandwidth, maintain costs at a reasonable level, and not require the installation of a new cable system. Unfortunately, we have two such contenders. What happens to those tapes when the last BetaMax player goes?

TWO CHOICES

As the dust settles after a year of IEEE standards committee proposals and politics, two proposals are emerging as head-to-head competitors: 100VG-AnyLAN and 100BaseX. We'll call them 100VG and Fast Ethernet, respectively, for clarity. You can compare 100VG with Fast Ethernet on both physical and management levels.

As do existing network solutions, these

two standards force PCs to share a common media, the cable, rather than using a switch to connect LANs, as ATM does. The shared-media architecture is less than perfect for time-critical applications such as real-time video and voice because the design can cause delays in the delivery of data, but it's certainly fine for common network activities such as loading network applications and large graphics files from servers. Like 10BaseT, 100VG and Fast Ethernet are both laid out in star configurations with a wiring hub.

Theoretically, the migration to either of these architectures should be straightforward. You should only have to swap adapters and wiring hub ports. The cabling and network drivers for connecting the PC and the adapter should remain the same. It should also mean that network managers can easily connect 100VG and Fast Ethernet to existing Ethernet networks.

Both 100VG and Fast Ethernet will run over Category 3 cabling—the type of unshielded twisted-pair wire commonly

installed for 10BaseT networks. In July 1991, the Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) released its higher-level Category 4 and 5 specifications for unshielded

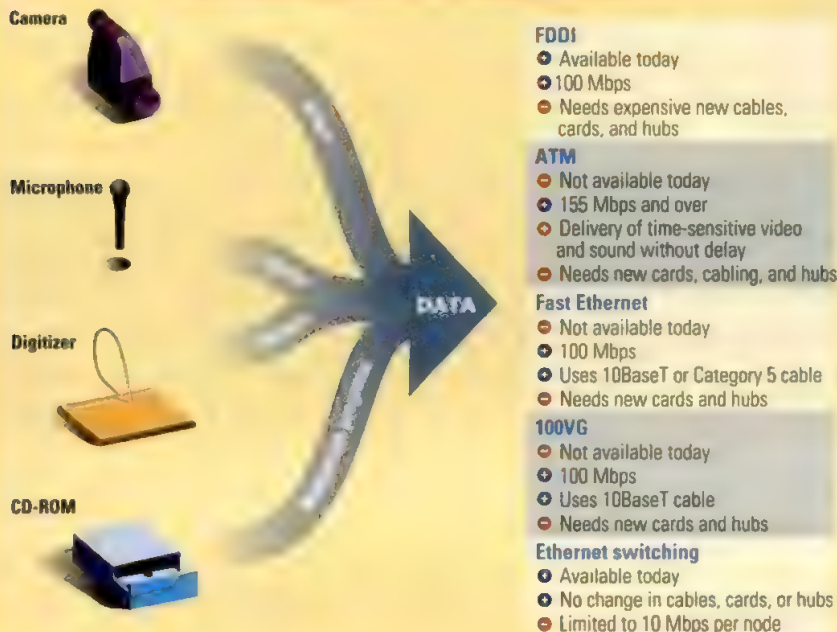
twisted-pair installations designed to support signaling speeds of 100 Mbps and higher, but these specifications came too late for many organizations with Category 3 cabling tucked neatly behind their walls.

The new systems try to move data quickly without requiring new cable. (For more information on cable categories, see "Mapping the Cable Mess," *PC Magazine: Network Edition*, July 1993.)

Although dozens of companies have announced intentions to build network adapters, hubs, routers, and bridges for high-speed networks, few companies have actually announced specific pricing. And don't expect to see any of these products until mid-1994. The 100VG group doesn't even expect to have its specification finalized until this spring.

The time is ripe for a scheme that provides speed faster than 10 Mbps, maintains costs, and requires no new cabling.

Alternative Paths to Faster Networks



There are different paths available to faster networks, and each is fraught with its own pitfalls.

DISTINCT IDENTITIES

A closer look at Fast Ethernet and 100VG reveals differences in how individual nodes share access to the cable and how the systems send signals across the wires. As the name implies, Fast Ethernet is the 100-Mbps version of the existing 10BaseT Ethernet and uses the same CSMA/CD (carrier sense multiple access with collision detection) media-access control (MAC). The IEEE 802.3 standards don't put any limits on signaling speeds, and Fast Ethernet fits in nicely with those standards. Some call Fast Ethernet "scaled CSMA/CD" since it uses the same MAC process as the other Ethernet technologies. The Fast Ethernet Alliance, the group of 16 companies backing the Fast Ethernet scheme, says that the only change from Ethernet is at the physical layer: the cabling and signal encoding on the cabling.

The CSMA/CD process uses logic on the network adapter to negotiate for cable



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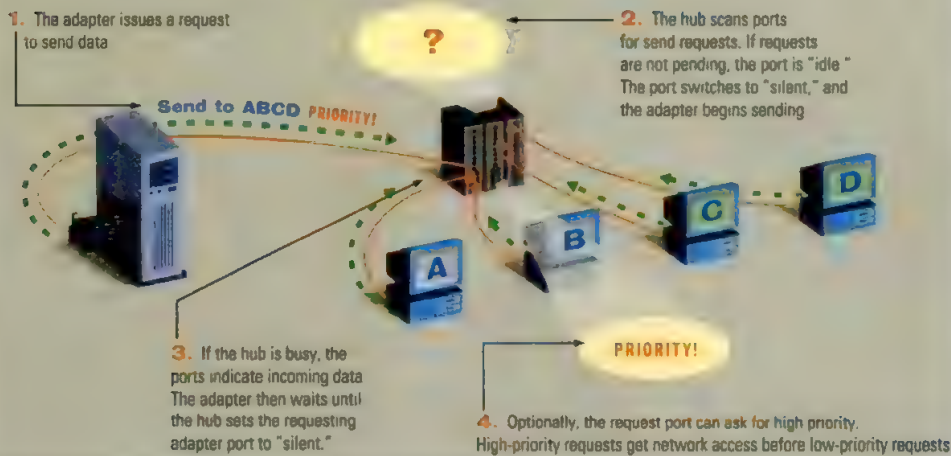
How Faster Ethernet Works

CSMA/CD* (Fast Ethernet)



* Carrier sense multiple access with collision detection

Demand Priority (100VG)



which controls access to the cable in an orderly manner rather than using the contention scheme of CSMA/CD. Unlike CSMA/CD, in which each Ethernet adapter independently monitors network activity and then broadcasts when it thinks the cable is clear, Demand Priority is deterministic. The 100VG hub serves as the traffic cop, providing equal access to each of the attached nodes. The hub scans each port to test for a transmission request and then grants the request based on priority. Once the hub gives the adapter access to the network, the node is guaranteed a full 100-Mbps bandwidth. The prioritization scheme in 100VG's new access system sets two levels of access priority. High priority requests jump ahead of low priority requests by other PCs on the same hub. The 100VG partners believe that applications, or perhaps driver stacks, will issue the requests for high-priority access based on the type

access. First, the adapter checks for traffic. If someone is already broadcasting on the cable, the adapter waits for a random time period and tries again. When the cable is free of traffic, the adapter begins to broadcast. The Fast Ethernet Alliance, backed by nuts and bolts networking-infrastructure vendors including 3Com Corp., National Semiconductor Corp., Standard Microsystems Corp., Intel Corp., and SynOptics Communications, appeals to the existing Ethernet knowledge base and predicts a smooth upgrade into Fast Ethernet products.

The committee was able to reach a performance improvement by decreasing the maximum size of the Ethernet network. On a CSMA/CD LAN, the size of the Ethernet LAN is tied to the time required to transmit a packet. If you increase the line speed, you are decreasing the time required to transmit a frame, which means there's less time for stations to detect the frame on the network. The

only solution is to decrease the size of network so stations have more time to detect the frame.

And that's exactly how Fast Ethernet operates. Since it increases Ethernet's line speed tenfold, it decreases the size of the network from 2,500 meters to 250 meters, still far more than the 100 meters needed to connect most computers to the wiring closet.

The competing networking option is 100VG from the powerful team of AT&T Microelectronics, Hewlett-Packard, and IBM. Designated as 802.3 by the IEEE, this topology supports not only Ethernet, but with slight modification, Token-Ring frames as well.

The 100VG developers tout a new signalling system, called Demand Priority,

of data queued up to cross the LAN.

While both standards will run over Category 3 cabling, they will need to use twice the number of pairs of wires due to FCC limitations on the amount of radio frequency energy their systems broadcast.

With a cap of 30 MHz on their transmission spectrum, the companies had to develop clever signalling schemes that used the two extra pair of Category 3 wires that most organizations installed in their 10BaseT system as spares.

Both Fast Ethernet and 100VG borrow physical-level signaling and encoding techniques from FDDI to operate on Category 3 cabling. Fast Ethernet uses the 4-bit/5-bit coding technique called ANSI PMD X3T9.5.

*This topology supports
not only Ethernet,
but with slight
modification, Token-Ring
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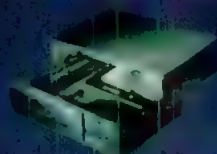


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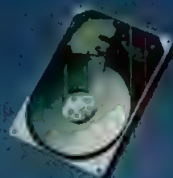
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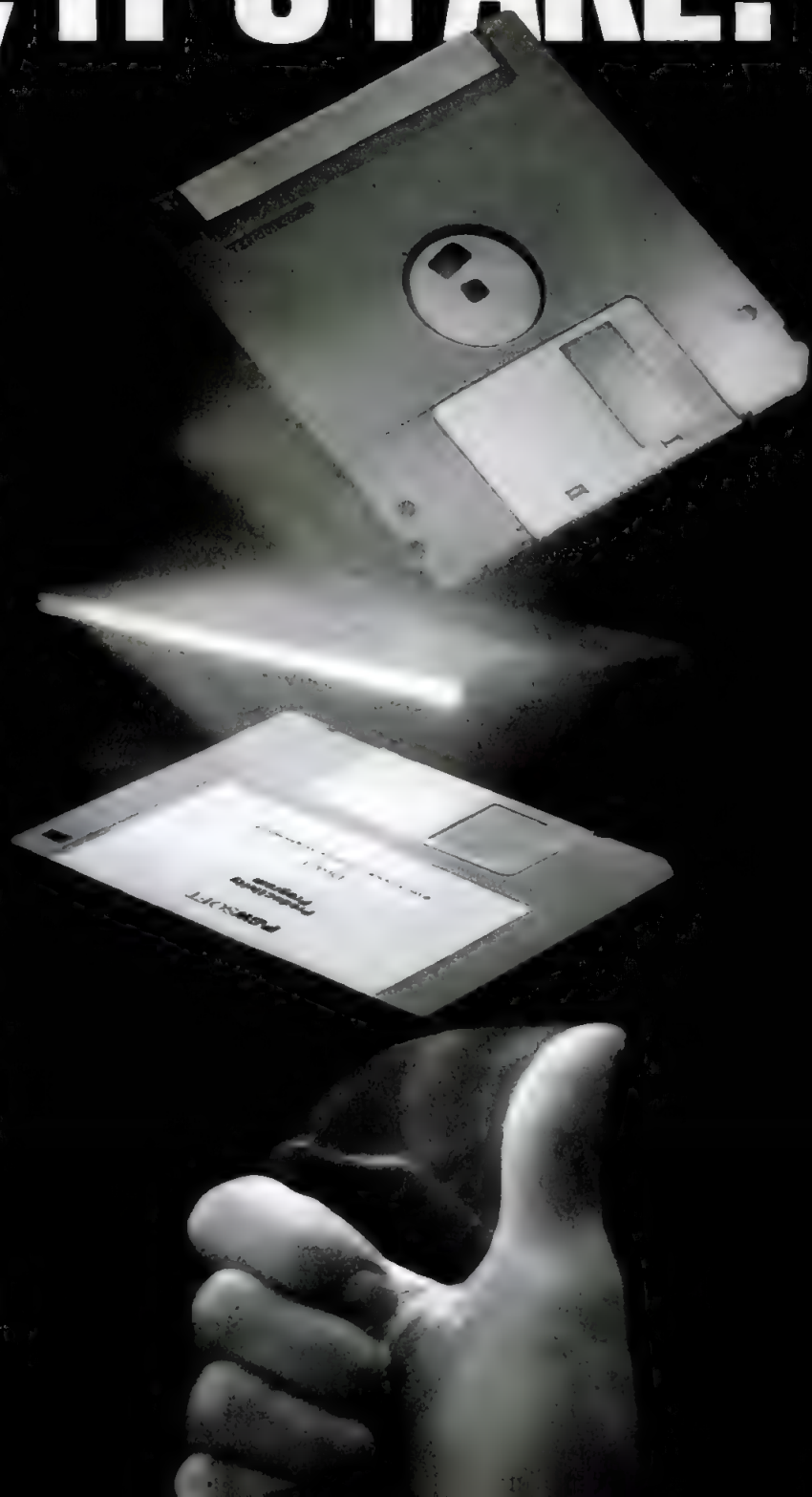
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TECHNOLOGY SPOTLIGHT

While the designers of Fast Ethernet originally planned to use the more robust Category 5, fiber, and IBM Type 1 shielded cabling, they responded to marketing challenge of the 100VG group with their own plan for signaling over Category 3 cable called 4T+. This technique still uses four pairs of wire in the Category 3 cable, but instead of running data over four pairs it uses three pairs for data and one pair for the CSMA/CD MAC process. Fast Ethernet also has a standard that uses only two pairs of Category 5 wire.

Products from the 100VG vendors will incorporate a technique called Quartet Signalling that sends data and access signals in parallel over all four pair at rates of 30 Mbps per pair. Since the real data is

split up into 5-bit words encoded onto the 6-bit data words, the effective data transfer rate is 100 Mbps.

LIMITATIONS

If you're tempted to look into either of these faster networking schemes, you should start your investigation in your own office with a screwdriver or a call to the people who maintain your wiring system. The critical question, which you'll find answered at the wall plate or the wiring closet, is whether or not you have the eight good wires (four pairs) these systems, 100VG in particular, need.

The next questions are how many pairs are necessary and how long are the cables? The 100VG system is limited to

Vendors of High-speed Ethernet

Company	Adapter	Hub	Chips	Switches
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Alentec Inc. 800-252-6832, 408-955-9000; fax, 408-955-9500	—	100VG	—	—
Artel Communications Corp. 800-525-2589, 508-562-2100; fax, 508-562-9032	—	Fast Ethernet	—	—
Asante Technologies Inc. 800-662-9686, 408-435-8388; fax, 408-432-1117	100VG	100VG	—	—
Bytex Corp. 800-232-9839, 508-366-8000; fax, 408-541-8980	—	100VG	—	—
David Systems Inc. 800-762-7848, 408-541-8000; fax, 408-541-8880	—	Fast Ethernet	—	—
D-Link Systems Inc. 800-326-1688, 714-455-1688; fax, 714-455-2621	100VG	100VG	—	—
Grand Junction Networks Inc. 800-747-3278, 510-252-0728; fax, 510-252-0915	Fast Ethernet	Fast Ethernet	—	Fast Ethernet
Hewlett-Packard Co. 800-752-0900, 800-387-3867 only in Calif., 415-857-1501; fax, 800-333-1917	100VG	100VG	—	—
Kaipano Inc. 800-488-0775, 408-749-1800; fax, 408-749-1690	—	100VG	—	—
Kodak Technology Inc. 800-888-8084, 510-226-7840; fax, 510-770-9042	Fast Ethernet	Fast Ethernet	—	—
Lanenet Data Communications Inc. 800-526-6388, 714-891-5580; fax, 714-891-7788	—	Fast Ethernet	—	—
National Semiconductor Corp. 800-538-8510, 408-721-5000; fax, 408-721-7862	—	—	Fast Ethernet	—
Optical Data Systems Inc. 214-234-6400; fax, 214-234-1467	—	100VG	—	100VG
Proton Inc. 800-545-7464, 508-899-2800; fax, 508-366-8901	100VG	—	—	—
SEED Technology 800-888-8084, 510-226-7840; fax, 510-770-9042	—	Fast Ethernet	Fast Ethernet	Fast Ethernet
Standard Microsystems Corp. 800-762-4968, 516-435-6000	Fast Ethernet	—	—	—
SynOptics Communications Inc. 800-778-8895, 408-988-2400; fax, 408-988-5525	—	Fast Ethernet	—	—
3Com Corp. 800-638-3268, 408-784-5000; fax, 408-784-5001	Fast Ethernet	Fast Ethernet	—	—
Ungermann-Bass Inc. 800-777-4526, 408-496-0111; fax, 408-970-7385	—	100VG	—	—
Wellfleet Communications Inc. 508-670-8888; fax, 508-436-3658	—	100VG	—	—

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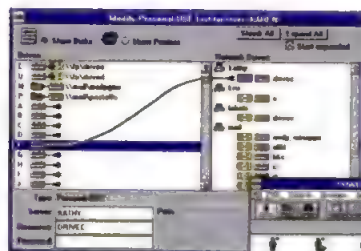
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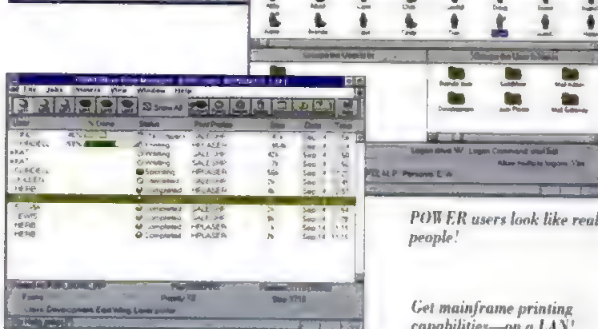


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Volume 9, Number 12 January 1993		Ease of Use & Functionality	Design & Power	Flexibility	Complete Evaluation
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TECHNOLOGY SPOTLIGHT

100 meters, the same as the formal 10BaseT standard, but while system integrators know that 10BaseT cable runs can often be as long as 175 meters and still work, that isn't the case with 100VG. The acceptable Fast Ethernet cable lengths vary with the type of cable. So, you need to know the length of each cable from the hub to the wall plate. As a minimum, you'll certainly need a cable survey, and you might need a new installation before you can use even the multi-pair signaling schemes designed to replace 10BaseT.

If your cable plant is already wired for Category 5 cable, you'll only need to use two pairs of wires for either 100VG or Fast Ethernet connections. The 100VG and Fast Ethernet teams worked hard to create specifications that will run over existing wiring of several types.

Each plan has its ups and downs. Since Fast Ethernet's CSMA/CD implementation is like Ethernet, vendors and network managers will be able to release equipment and troubleshoot problems quicker than with 100VG. However, Fast Ethernet doesn't guarantee the prompt passage of time-sensitive data, so it isn't the best choice for networks moving data and voice.

Just as Ethernet does not scale well with many clients, Fast Ethernet may not be very scaleable. Further testing will be needed to determine the maximum practical number of nodes on the LAN.

Similarly, the 100VG system uses a new access control scheme that doesn't have the millions of hours of successful, road-proven technology behind it. On the flip side, Demand Priority, which is in some ways similar to an ARCnet access scheme, provides more opportunity for a node with time-sensitive traffic to get it onto a crowded network. And with support for Token-Ring you now have a smooth migration for all of your LANs. Still, users of the 100VG system will have to be sure that they are buying the right 100VG equipment that supports the access method (Ethernet or Token-Ring) used in their office.

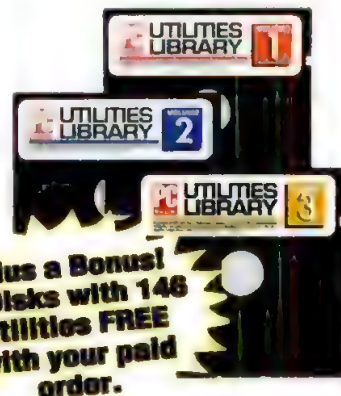
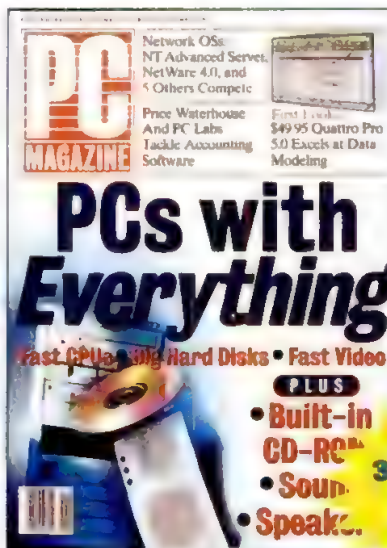
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announced predelivery prices. Vendors on both sides of the fence claim 100-Mbps network components—adapters, hubs, concentrators, and others—will cost about twice the price of existing components. For example, D-Link Systems expects to sell 100VG adapters for \$395 and 16-port hubs for about \$3,190. Today's Ethernet adapters list for between \$99 and \$300, and hubs start at \$500. Also, many hubs can be upgraded to support the new high-speed network technology. Companies such as Ungermann-Bass will have modules for their Ethernet hubs to connect 100VG networks.

The hubs will be the simple part of installing either Fast Ethernet or 100VG: Just rip out the old and plug in the new. Installing the adapters will be more cumbersome. Hewlett-Packard expects 100VG network drivers to snap into existing LAN workstation interfaces such as Novell's IPXODI driver. The company plans to supply network-specific drivers for NetWare, VINES, LAN Manager,

and several flavors of Unix. Nonetheless, opening up hundreds of computers, pulling old adapters, installing new ones, adding drivers, and fine-tuning memory management will be an onerous task.

*The hubs will be
the simple part of installing
either Fast Ethernet or
100VG: Just rip out the old
and plug in the new.*

So we face a dilemma of standards identical to the VHS and BetaMax videotape wars of nearly a decade ago. Proponents from both camps see their technology as complementing 10BaseT and FDDI and as superior to other high-speed media such as ATM. Whichever technology you invest in, you could find yourself without a source of additional

parts or updated software.

As you struggle with network decisions, don't lose sight of existing economical, plug-and-play products that are available off the shelf today. Specifically, Switched Ethernet systems provide increased throughput with excellent economy. They don't provide 100-Mbps speeds to the network nodes, but depending on the size of the files being sent across the network, their multigigabyte backplanes can often provide effective throughput equal to the shared-media solutions proposed by the 100VG and Fast Ethernet vendors.

Real 100VG or Fast Ethernet products aren't here yet, so you've got plenty of time to survey your cable installation to see if it will support the 100VG or Fast Ethernet systems. No matter what anyone says, there's no free ride over your 10BaseT roadway.

Tony Pompili is a client service manager for Ziff-Davis Information Services and a frequent contributor to PC Magazine.

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FIRST LOOKS

HANDS-ON EVALUATIONS OF THE NEWEST NETWORK PRODUCTS

► NETWORK MANAGEMENT

NAT Offers No-Frills RMON Statistics for Windows

BY JEFFREY D. BAHER

Feeling overwhelmed by the bits, bytes, packets, and protocols that travel your LAN? Network Application Technology (NAT) offers a standard-based, combined software and hardware solution designed to put you, the network manager, back in control. Based on SNMP's Remote Monitoring Management Information Base (RMON MIB), the NAT solution comprises the NAT NMS/100, Version 2.12—a Windows-based management console—and the NAT LANB/450 Remote EtherMeter RMON probe. While this package delivers raw RMON statistics, however, it stumbles on the presentation of those statistics as well as on its functionality as a Windows-based platform—both of which are important considerations in the RMON market.

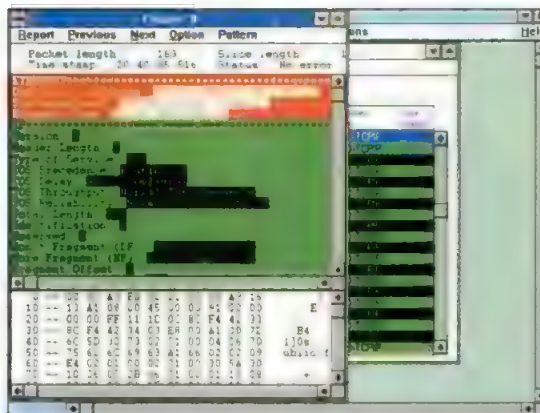
The RMON MIB is quickly gaining acceptance in the SNMP world as an effective tool for monitoring and analyzing network traffic. There are proprietary solutions, such as Network General's Distributed Sniffer, that perform similar functions, but RMON benefits from being a standard and thus supporting multivendor interoperability. With an RMON probe, or agent, placed on the network and a console to view captured RMON data, the network manager can gain a clear view of the traffic patterns on the network.

Configuring the NAT console and the LANB450 EtherMeter are relatively

straightforward tasks. Console configuration involves installing the NMS/100 console software and the NAC/102 Ethernet adapter that comes with it. Installation of the LANB450 is also simple: Just make sure the DIP switches are properly set and power it on. The LANB450 will take care of the rest and receive the required configuration information either in-band over the network or out-of-band via the serial port.

To view RMON information, locate the LANB450 on the user-defined network topology map and double-click with your mouse. A pop-up menu will appear that provides access to a set of tools, one of which is the RMON Device Application (RMON DA). Seven menu choices under the RMON DA heading provide access to data in the nine groups defined by Request for Comment (RFC) 1271, a document on the

Continues on page NE16



BREAKING THE CODE: NAT's decode features provide you with a detailed view of your Ethernet packets.

► ETHERNET ADAPTER

IBM's EtherStreamer Supports Full-Duplex Ethernet Technology

BY STEVE BUEHLER

Those of you looking to get every last ounce of performance out of your Ethernet LAN should know that full-duplex Ethernet has arrived. This technology, pioneered by switch manufacturer Kalpana, is designed to wring more bandwidth out of existing Ethernet installations, originally in the high I/O area of inter-switch communication. IBM's new EtherStreamer 32 MC brings full-duplex technology to your server, another likely

area of network I/O contention. This adapter, available for a suggested retail price of \$595, offers competitive Ethernet adapter performance along with support for network installations seeking to solve I/O bottlenecks by adopting full-duplex Ethernet technology.

Full-duplex Ethernet allows a server, switch, or workstation to transmit and receive data simultaneously on a standard Ethernet cable hooked to a similarly equipped server, switch, or workstation

Continues on page NE18

Network Application Technology

CONTINUED FROM PAGE NE15

Internet that outlines the RMON standard: Statistics, Host, Host TopN, Matrix, History, Alarms, Events, Packet Capture, and Filter.

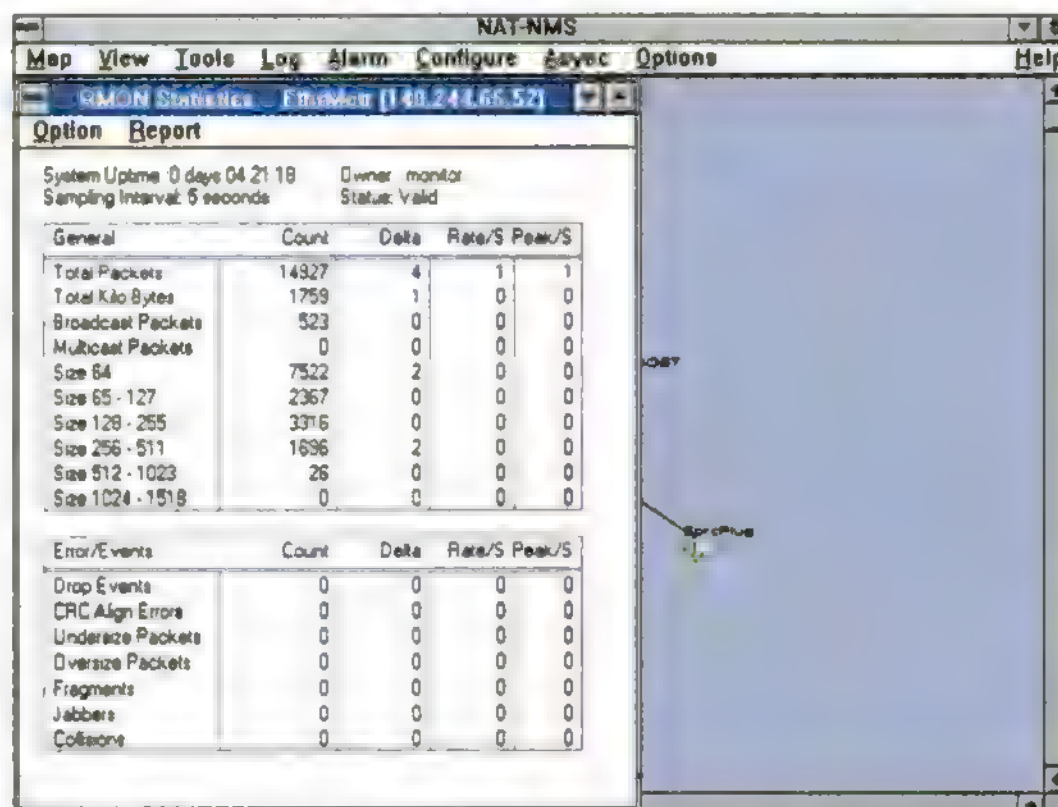
RMON Statistics provides network statistics compiled by the EtherMeter and breaks down network traffic according to a wide range of criteria, including total packets, broadcast packets, packet size, cyclic redundancy check (CRC), align errors, and collisions. For node-specific statistics, the RMON Host reports the throughput of bytes and packets sent and received by each device. Host TopN lists the ten most active devices on the network.

To monitor conversations on the network, RMON Matrix function allows you to view the source and destination of network traffic quickly. Essentially, RMON Matrix lets you see who is talking to whom. If you are more concerned with the flow of traffic over a certain period of time than with the actual conversations, you can use RMON History function to monitor statistics, such as total packets, broadcast packets, or errors, over a designated interval of 60 minutes or less. If you need a longer historical view of your network, NAT's Trend Analysis feature, which is not part of RMON, can log network activity for days.

NAT also includes support for RMON Alarm and RMON Event for defining RMON-specific alarms and events. For example, you can define an event specifically to track 64-byte packets. You can then set an alarm that will notify the network manager when the number of 64-byte packets is higher or lower than your defined thresholds. The event and alarm functions are particularly helpful for monitoring mission-critical statistics such as broadcasts and collisions.

For low-level network analysis, the RMON Capture and Filter tools are effective. Using the Filter capabilities, a

user can capture a certain type of packet and then use the Trace command to view them. Clicking on a particular packet will launch an expanded view displaying packet decode information. NAT offers decoding support for all the major proto-



SIZING UP THE SITUATION: The RMON Statistics function groups statistics into several categories, including packet size.

cols including TCP/IP, IPX, AppleTalk, DECnet, and XNS. The NMS/100 supports as many as five concurrent packet captures, each of which can be based on different filters.

Besides supporting the nine subgroups

The differentiating factors among RMON packages are the user interface and graphics capabilities.

of the RMON MIB, the NMS/100 also offers complete SNMP support. With the SNMP DA, SNMP Get and Set commands can be sent to the LANB450 or any other SNMP device. The NMS/100 comes with MIB-2 and NAT private MIBs precompiled to provide quick access to SNMP variables. A utility that compiles non-NAT device MIBs is also included.

Since RMON is a standard, the information generated will be the same regard-

less of the RMON package used. The differentiating factors among RMON packages, therefore, are the user interface and graphics capabilities. And this is exactly where the NAT solution comes up short. Put simply, the NMS/100 console is bland,

offering limited use of colors, graphs, and other visual aids to depict RMON data. Compared with other RMON packages such as Novell's LANalyzer or Frontier Software Development's NETScout, for example, which are far more creative in their presentation of RMON data, this package clearly has room for improvement.

Besides suffering from NAT's no-frills approach to presentation, NAT's NMS/100 also comes up short in terms of integration. NAT's biggest competitors in the Windows-based RMON market are Hewlett-Packard's ProbeView

and Novell's LANalyzer, both of which run under a broader management platform, Hewlett-Packard's HP OpenView for Windows and Novell's NetWare Management System, Version 2.0 (NMS), respectively. Using these products, general network management as well as RMON-specific management can both be executed from the same workstation. But NAT's NMS/100 solution does not offer a comparable management platform. Additionally, while NAT offers RMON statistics and SNMP management, it does not provide auto-discovery and mapping features as do its competitors.

From a cost standpoint, you'll get much more from investing in NMS or OpenView. LANalyzer and ProbeView may cost a little more because they require the management platforms as well, but the added functionality and scalability outweigh the extra cost.

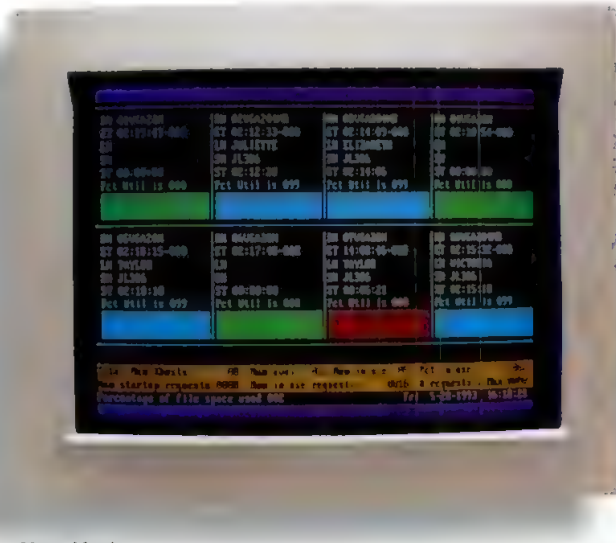
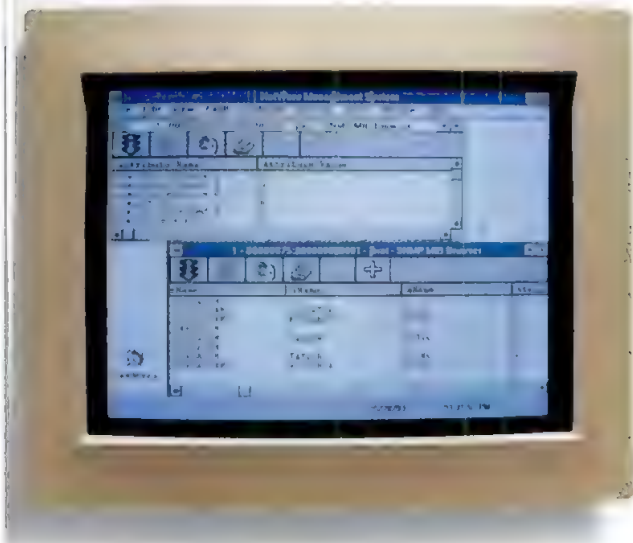
• List price: NAT NMS/100, Version 2.12 for Windows, \$2,495; NAT LANB450 Remote EtherMeter RMON, \$2,895. Network Application Technology Inc., 1686 Dell Ave., Campbell, CA 95008; 800-543-8887; fax, 408-370-4222.

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IBM

CONTINUED FROM PAGE NE15

without concern for collisions. Standard 10-Mbps Ethernet uses half-duplex technology, which, in order to avoid possible collisions, limits Ethernet stations to either transmitting or listening. Using point-to-point connections, full-duplex Ethernet eliminates this contention for bandwidth, giving the user a full 10 Mbps in each direction.

Full-duplex Ethernet requires that both ends of each point-to-point connection support full-duplex. Currently, only two switches—the Kalpana EPS-500 and the Kalpana EPS-1500 (reviewed in “Switch Pioneer Kalpana Now Offers Bidirectional Ethernet,” *PC Magazine, Network Edition*, November 9, 1993) offer this capability. Until IBM’s release of the EtherStreamer 32 MC, the only Ethernet adapter that supported full-duplex Ethernet was the EISA Compaq NetFlex-2, available for the Compaq Systempro, ProSignias, and ProLiant.

We tested the EtherStreamer in both half- and full-duplex modes using ZD Labs’ NetBench 2.1 NIC I/O Throughput test. The results indicate that the 32-bit IBM in half-duplex mode outperformed the popu-

Full Speed Ahead for Full Duplex?

Support for full-duplex Ethernet technology is beginning to spread. Several networking vendors, including Cabletron Systems, National Semiconductor, and Hughes LAN Systems, have announced plans to develop full-duplex products for release in the near future. Other companies, such as IBM, Kalpana, Kodiak Technology, and Compaq, have already delivered.

The increasing number of available products on the market may help to

enhance the appeal of full duplex as an alternative to newer, higher-speed network technologies.

Nevertheless, full-duplex technology figures to face stiff competition from these other technologies, Fast Ethernet in particular. After all, full duplex and Fast Ethernet target the same general applications, such as server-to-hub connections, and the lure of 100-Mbps throughput may be enough to sway most network managers.—Michael Ryan

lar 3Com EtherLink III, Model 3C523 16-bit adapter (\$377), edging the 3Com slightly in handling small, 1MB files. To test in full-duplex mode, we rebooted the IBM with a different driver command line parameter. In full-duplex mode, where the 3Com cannot compete, the IBM was roughly 20 percent faster than the 3Com in small, 1MB test runs. Though the performance improvement is significant, it’s not nearly the 100 percent increase expected from doubling Ethernet’s bandwidth. The two main reasons for this are that most current protocols have been optimized for half-duplex, and most applications don’t

require concurrent reads and writes. Our test mimics typical system accesses, which are three read requests for each write request.

The IBM EtherStreamer 32 MC is a capable Ethernet adapter in either half- or full-duplex mode. As such, it is a part of a coherent strategy for solving specific network I/O issues. The IBM’s half-duplex performance allows a savvy buyer the option of later adopting a full-duplex solution should network traf-

fic warrant. If your network has I/O bottlenecks between servers and switches that cannot be mitigated by segmenting your network with multiple cards in the server or reconfiguring your network to balance the traffic load, a full-duplex Ethernet solution can offer increased I/O throughput between those network nodes. This option, which requires full-duplex Ethernet cards in servers and full-duplex switches, will result in somewhat better I/O throughput, especially if most network traffic consists of smaller packets and higher read/write activity. This technology is perhaps best viewed as a suitable option for those sites that would rather spend small amounts of money upgrading adapters and switches than large amounts of money committing to the expense and difficulty of a Fast Ethernet or fiber solution. This solution builds on the current infrastructure and is therefore evolutionary, while Fast Ethernet or fiber lay the groundwork for long-range network improvements.

The IBM EtherStreamer 32 MC offers strong half-duplex Ethernet adapter performance at a competitive price. With its scalability, it offers the flexibility of implementing full-duplex Ethernet to users who need the additional throughput at the server but who are constrained by cost, plant layout, or other factors from jumping on a high-speed bandwagon.

• List price: *IBM EtherStreamer 32 MC*, \$595. *IBM Corp.*, 1133 Westchester Ave., White Plains, NY 10604; 800-426-3333; fax, 800-426-2255.

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Benchmark Test: Full-Duplex Ethernet Adapter

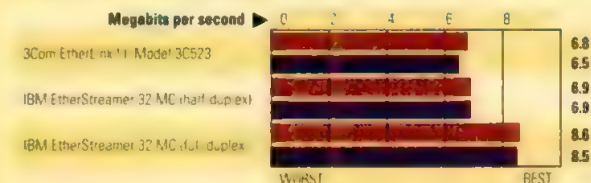


The IBM EtherStreamer 32 MC outperformed the 3Com EtherLink III in both full- and half-duplex mode. The benefits of full duplex were readily apparent during the file-transfer test runs that use small file sizes, as the IBM displayed as much as 20 percent higher throughput.

For this test we used an IBM PS/2 Model 90 as the server. We connected three Compaq ProLinea 4/33 workstations to the server through a Kalpana EPS-1500 switch supporting full-duplex Ethernet. The NIC I/O Throughput test from NetBench 2.1 measures the amount of data that an adapter can transfer across the network in 1 second. A PC equipped with the adapter issues a series of read and write requests to a file stored in the server’s 1MB cache. The test uses block sizes ranging from 512 bytes to 4K.

NIC I/O THROUGHPUT (4K blocks)

■ Read only ■ Read/write



► NETWORK MANAGEMENT

Picture Your Network with netViz

BY STEVE RIGNEY

Whether you use a white board or a piece of paper, mapping out your network is important. When you plan for additions, troubleshoot a problem, or look for ways to trim the budget, it pays to pull out a blueprint for the system you've created. Quyen Systems' netViz, Version 1.0, at \$395, is an ideal tool for drawing that blueprint and documenting your network.

netViz combines a Windows-based drawing utility with a database management application. You can use netViz to design and document complex LANs, WANs, work flows, and flowcharts. This is the first network planning and documentation tool that integrates data with graphics to create a complete picture of a network or work flow process. Other products, such as VisiSoft's VisiNet, also provide a graphical picture of your network but are limited to displaying the devices that are already installed.

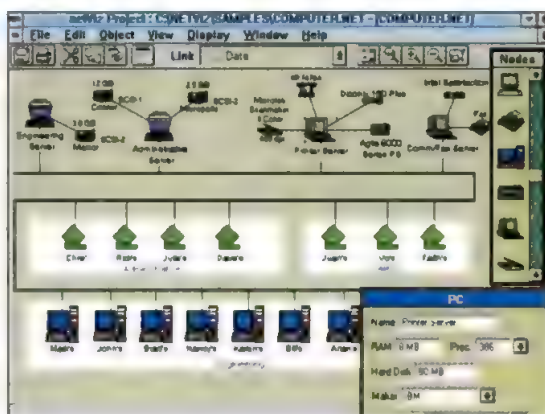
Each diagram comprises three components: background, individual nodes, and links. The background is typically a bitmap of an office or a geographical area like a city or state. The netViz package comes with several backgrounds, including a map of the United States. You can also import .PCX, .WMF, TIFF, .BMP, and .DRW files to use as backgrounds. The background object is a separate file, so if you change the arrangement or number of nodes or links, the background stays the same.

Individual nodes can be anything from offices, mainframes, and satellites to client PCs and file servers. You can click on each node to access database information such as manufacturer, model, and user information on that node. You can also create multilayered nodes that contain various different components.

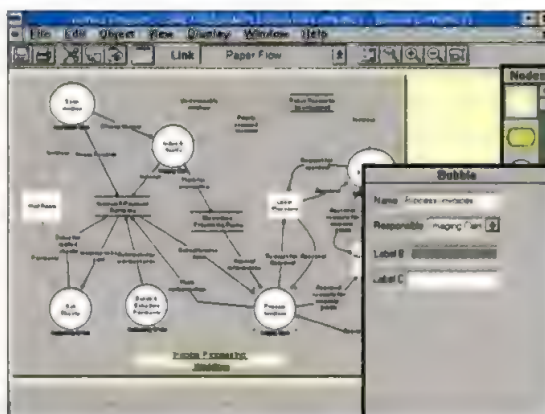
Links connect the individual nodes within an office or across the country. netViz includes link diagrams for several types of connections, including T1, ISDN, and Switched 56. If you move a node, the link automatically moves with it. Links

also contain database information regarding the name and type of the connection.

netViz can link network diagrams with multiple sublayers that depict individual offices or network nodes. Each diagram is also linked to a database that contains



PEOPLE, PLACES, AND THINGS: netViz lets you create diagrams to show where your equipment and users are.



PLANNING THE PROCESS: You can also use netViz to document detailed work flow procedures.

information regarding that particular diagram. The ability to link various layers of a diagram will save you the time and frustration of trying to create a two-dimensional diagram using paper or a white board.

netViz includes detailed libraries of icons for all of your nodes, links, and backgrounds. Creating a diagram is as easy as dragging an icon from the palette.

In addition to its network mapping capability, netViz offers the ability to dia-

gram and document complex work flows and flowcharts. You use the concept of nodes, links, and backgrounds to create a process work flow. The only difference is that nodes represent people and processes rather than machines. netViz is ideal for developing standardized work procedures for training employees. For example, you can create a work flow diagram that describes the process of posting invoices to the general ledger or of performing a daily backup.

netViz is one of the easiest Windows-based graphics programs to use. The program is so easy to use that you can start creating complex diagrams within minutes of installing it. You probably won't even need the detailed tutorial. The main reason netViz is so easy to use is the absence of the confusing menus normally found in other graphics programs such as CorelDRAW and Harvard Graphics. netViz is designed specifically for creating network and flowchart diagrams and does not require the other features needed to create charts and slide shows.

Unfortunately, netViz is not an inventory application, and you must take the time to discover and input all of the information about each node on the network. However, netViz does allow you to customize your own data entry fields so you can track specific data about your network components.

The type of diagram you can create with netViz is one of those things that you don't realize you need until it's too late.

While netViz is best suited for medium- to large-sized networks, its low price tag and ease of use make it an attractive product for any network systems integrator or administrator who wants to create a graphical blueprint of their network.

• List price: netViz, Version 1.0, \$395. Quyen Systems Inc., 1300 Piccard Dr., #108, Rockville, MD 20850; 301-258-5087.

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► PRINT SERVER

XJet Supports Multiple Protocols

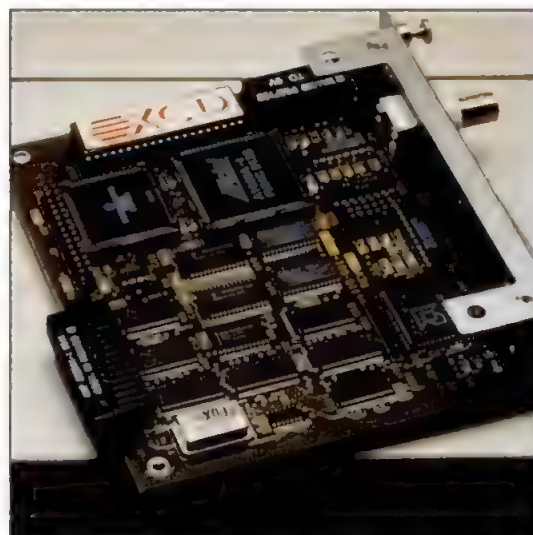
BY STEVE RIGNEY

Most veteran network administrators would rather pull cable through an attic or clean ten year's worth of dust bunnies out of a PC XT than tackle the installation of a new networked printer. Fortunately, XCd's multiprotocol XJet IV print server provides a more pleasant alternative to extensive installation procedures and limited protocol support. When you plug the XCd XJet IV into a Hewlett-Packard IIISi, 4, or 4Si laser printer; DesignJet plotter; or PaintJet XL300 color printer, you get an instant Ethernet connection that works with three common network protocols: IPX, TCP/IP, and Digital's LAT. The XJet IV retails for \$695, and it's easy to use.

Unlike external print servers, such as

Xircom's Pocket Print Server, the XJet IV print server plugs directly into your HP's Modular Input/ Output port rather than the parallel port and does not require an additional power supply. The direct connection to the printer's bus provides faster throughput than an external print server. On the other hand, an external print server gives you the flexibility to turn any printer you have into a networked printer. Also, companies such as Intel and Lexmark offer external print servers that can simultaneously connect to two or more network printers for greater overall economy.

The XJet IV Ethernet print server is available in either a 10BaseT model with



MULTILINGUAL: XCd's new multiprotocol print server for Hewlett-Packard printers supports IPX, TCP/IP, and LAT.

an RJ-45 connector or a 10Base2 model that includes both a BNC and an AUI connector. However, due to different equipment designs, an external transceiver will not work on the AUI port of

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When you're ready for management, instead of buying an entire managed box, you can just plug an SNMP management module into the back of any LinkBuilder FMS hub. This will

the XJet if you have a LaserJet 4 or a PaintJet XL300 printer. XCd does not currently have a Token-Ring version of the XJet.

The ability to use several protocols is the most appealing aspect of the XJet IV. Because it supports IPX, TCP/IP, and the LAT protocols, you can use the XJet to network a printer to NetWare, Pathworks, or Unix client computers. Additionally, XCd plans to add support for Apple EtherTalk in the near future. Emulex's NetJet supports IPX, TCP/IP, LAT, and EtherTalk but can only function under NetWare as a remote printer device.

The XJet IV's Xconfig program is used to configure your print server for the desired network protocol. After the initial setup, you can monitor and control print jobs using your standard printing applications. For example, you can monitor and control print jobs on the XJet IV using the NetWare PCONSOLE utility. The Xconfig utility also lets you view a graphic representation of

your HP printer's menu panel from a network client.

The XJet IV works with both Printer Control Language (PCL) and PostScript printers. If your printer has the ability to emulate both languages, the XJet IV will automatically determine the type of language used in an incoming print job and switch between PostScript and PCL. For Digital users, the XJet IV provides language translation for LNO3, Digital's printer language.

The XCd XJet IV package includes a copy of Northlake Software's PrintKit Network Printing Services. The PrintKit utility allows Digital VAX VMS users both to control and monitor print jobs. You can use PrintKit to create custom borders and multiple forms on VMS print jobs.

XCd also offers the XJet III print server, which supports Hewlett-Packard II, IID, III, and IIID laser printers. Finally, XCd offers the Xconnect external print server, which supports any printer with a Centronics or parallel connector.

Each member of the XCd X family of network print servers is designed for expandability. You can upgrade your XJet or Xconnect via Flash ROM to support new protocols as they become available. This is an important consideration as networks increasingly sport new cross-operating system and cross-platform capabilities.

While some print servers offer flexibility in printer choice but also limited protocol support, the XCd XJet IV offers not only multiprotocol capability but also easy installation, making it appealing to any network administrator who needs to add an HP printer to the LAN. The price of the XJet IV is competitive with similar products, and XJet will offer you expandability for the future.

• List price: *XCd XJet III*, \$695; *XCd XJet IV*, \$695; *XCd Xconnect*, \$795. *XCd Inc.*, 2172 Dupont Dr., #10, Irvine, CA 92715; 714-476-7855; fax, 714-752-0609.

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▶ TOKEN-RING ADAPTER

Thomas-Conrad Blasts into EISA Market

BY O. RYAN TABIBIAN

Thomas-Conrad Corp. leaps into the EISA Token-Ring market with the TC4047 Token-Ring EISA Adapter, one of the first cards on the market to feature the new Packet Blaster chip set. Thomas-Conrad's first EISA Token-Ring adapter improves upon its ISA counterpart in two ways. First, it uses the Packet Blaster chip, from Texas Instruments (TI), which was designed to increase adapter performance by handling packets at a much faster rate than traditional Token-Ring chip sets. Second, the card has a new Virtual Bus Design, which is composed of a Ring Interface and a system bus that make efficient use of the card's 128K buffer. The TC4047 did not perform as well on our tests as the current performance leader, the Madge Smart 16/4 EISA Ringnode, but it has some very

attractive features and holds promise for the future.

Several other adapter vendors, including Proteon and Compaq, are planning to use the Packet Blaster on both Token-Ring and Ethernet cards in the near future. This chip differs from the National Semiconductor Tropic and from original TI Token-Ring chip sets by moving the microcode from software to hardware, and having the chip carry out many of the functions previously performed by drivers. The Packet Blaster, unlike its predecessors, is transparent to the driver. Because of this, adapter vendors are not required to rewrite drivers, although many have opted to do so in order to increase performance.

Unfortunately for Thomas-Conrad, our tests revealed that the throughput of the TC4047 lagged consistently behind that of the Madge Smart 16/4 EISA Ringnode

adapter. We feel that this is due to the fact that Thomas-Conrad is still in the process of optimizing its drivers to take full advantage of the Packet Blaster. Due to an integrated 80186 processor, the TC4047 yielded very low CPU utilization, though not as low across the board as the highly efficient Proteon 1990. We were not able to test the card in a workstation environment, since Thomas-Conrad has not yet provided a workstation driver for this card.

If you are planning to buy a Token-Ring card, the TC4047 is a good choice, but one that should be weighed carefully. The card does have attractive features such as the Packet Blaster chip, Virtual Bus design, and very low CPU utilization. You also get toll-free technical support 24 hours a day, 7 days a week. But until an optimized and proven driver is available, you can get better performance from the Madge Smart 16/4 EISA Ringnode.

• List price: Thomas-Conrad TC4047 Token-Ring EISA Adapter, \$995.
Thomas-Conrad Corp., 1908-R Kramer Ln., Austin, TX 78758; 800-332-8683.
Circle 960 on reader service card

Benchmark Tests: Token-Ring Adapters

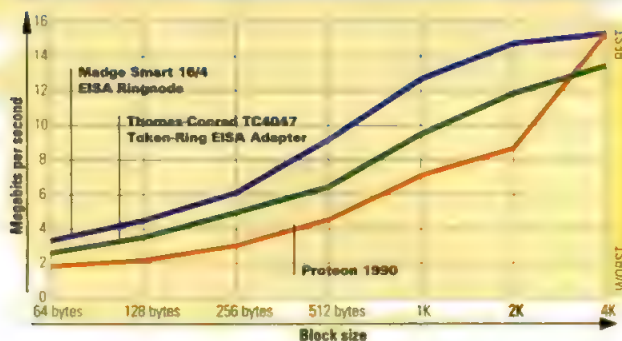


Although Thomas-Conrad's TC4047 Token-Ring EISA Adapter was not the fastest of the group, it performed well. The TC4047 was slower but more efficient than the performance-leading Madge Smart 16/4 EISA Ringnode adapter. It outperformed the Proteon 1990 on most block sizes but could not match the Proteon's excellent CPU utilization figures in most cases.

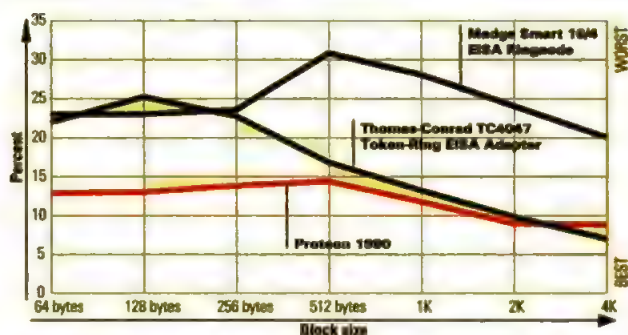
The NIC Throughput test from NetBench 2.1 measures the amount of data that an adapter can transfer across the network in 1 second. A PC equipped with the adapter issues a series of read requests to a file stored in the server's 1MB cache. The tests use block sizes ranging from 64 bytes to 4K. Results are reported in megabits per second (Mbps).

The Performance Index is the ratio of bandwidth utilization to CPU utilization. To measure CPU utilization we used Novell's STAT NLM

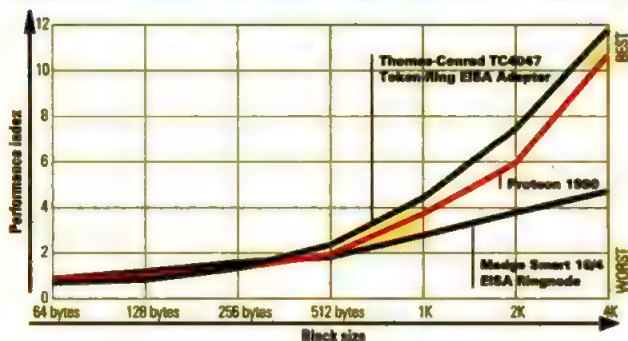
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CPU UTILIZATION



PERFORMANCE INDEX



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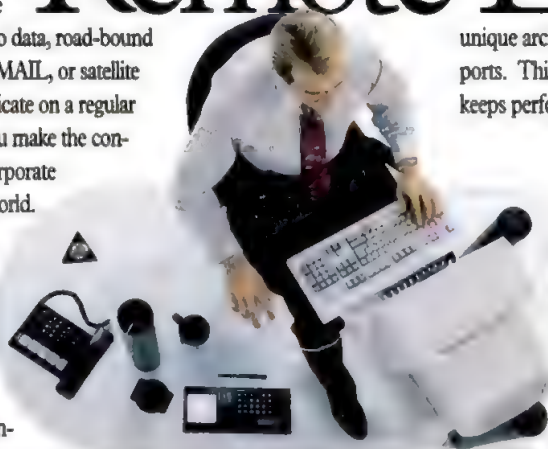
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NEW & IMPROVED

NEWS OF ANNOUNCED NETWORK PRODUCTS AND UPGRADES

NEW

Digital Equipment Announces ATM Products

Digital Equipment Corp., one of the major players in the development of technology and standards for ATM, announced the upcoming availability of ATM switches, connections, and adapters, as well as a two-year plan for the rollout of its complete line of ATM products. With these product announcements, Digital begins its three-stage strategy for implementing ATM.

The three products being introduced are a premises ATM switch that features 13 slots, a maximum of 52 ports, and support for SONET OC3 (Synchronous Optical Network Optical Carrier Level 3) speeds of 155 Mbps; a 155-Mbps SONET adapter for TURBOchannel that enables DEC 3000 AXP systems to connect directly to ATM networks; and the GIGAswitch 2-port ATM line card that provides migration from switched FDDI to high-speed WANs using T3 (44.7 Mbps) or SONET.

This first stage focuses on the connection of workgroups. Stages two and three will concentrate on connecting legacy Ethernet and PCI-bus servers into an ATM LAN and enabling desktop systems to integrate with the ATM LAN. Stage two products will include a DEChub 900 ATM-to-Ethernet module, a workgroup ATM switch, and a PCI adapter. Stage three will revolve around additional hub modules, additional PCI adapters, a new line of cards for ATM switches, and a DECNIS ATM interface. The stage one products will be available in the first quarter of 1994.

• List price: *Digital Premises ATM Switch, Digital 155-Mbps SONET Adapter for TURBOchannel, Digital GIGAswitch 2-port Line Card, pricing to be announced.* Digital Equipment Corp., 146 Main St., Maynard, MA 01754; 508-493-5111.

Circle 952 on reader service card

NEW

Router Configuration Gets Easier for Cisco Users

Interface	Description	Shutdown	Bandwidth	Ring Speed
Ethernet 0	Finance LAN	☒	10000	
Ethernet 1	Marketing LAN	☒	10000	
Serial 0	Paris - London	☒	1044	
Serial 1	Paris - New York	☒	1044	

NETWORK EASE: Configuration Builder simplifies router configurations.

Cisco Systems seeks to simplify network configuration with the introduction of Configuration Builder, an application that simplifies the initial configuration of Cisco's routers.

Configuration Builder allows users to configure multiple routers from the same screen simultaneously, as well as create snap-ins (predefined configuration building blocks) to reduce configuration time and errors. The application also includes tools for viewing, checking, and changing interrelated configuration parameters. The initial Windows-based version will be

available in the first quarter of 1994; versions for SUNnet Manager, HP OpenView, and NetVIEW 6000 will follow later in the year.

• List price: *Configuration Builder, \$495.* Cisco Systems Inc., 1525 O'Brien Dr., Menlo Park, CA 94026-1435; 415-326-1941; fax, 800-326-1941, 415-326-1989.

Circle 953 on reader service card

HOT PROSPECT

Novell Adds IP to NetWare Checklist



Novell enables users to run their protocol of choice by seamlessly integrating NetWare and TCP/IP. With the recent introduction of NetWare/IP, users can run NetWare network services and applications in TCP/IP environments. NetWare/IP users can now run NetWare over the Internet Protocol (IP) as well as over the Internetwork Packet Exchange (IPX) transport.

NetWare/IP is a set of NetWare Loadable Modules that enables existing NetWare 3.1x or 4.01 servers to use IP as a transport protocol option. Novell is positioning NetWare/IP not as a replacement for its IPX/SPX protocol, but instead as an alternative for companies who have already invested in a TCP/IP network but also want the advantages of NetWare's services. NetWare/IP can also serve as a gateway, connecting NetWare and NetWare/IP networks.

• List price: *NetWare/IP: 5-user version, \$500; 25-user version, \$1,400; 100-user version, \$2,600.* Novell Inc., 122 East 1700 South, Provo, UT 84606-6194; 800-453-1267.

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NEW

Novell Adds Personal Touch to NetWare

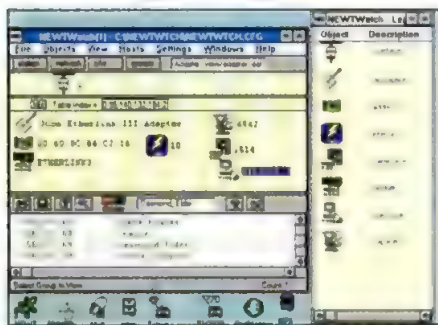
Novell provides a simple, scalable growth path from a peer-to-peer network to a large NetWare environment with the introduction of Personal NetWare. As the replacement for NetWare Lite, Version 1.1, Personal NetWare provides Microsoft Windows and DOS users with the ability to share resources such as files, printers, CD-ROMs, and standard network applications. This peer-to-peer networking solution provides seamless integration with NetWare through a consistent user interface across all NetWare environments. Personal NetWare features a distributed and replicated resource directory (similar to Novell's NetWare Directory Services) providing users with a single network view for assessing network services and resources. Additional features include simplified network administration and increased security.

• List price: *Personal NetWare: single-user version, \$99; 5-user version, \$395. Novell Inc., 122 East 1700 South, Provo, UT 84606-6194; 800-453-1267, 801-429-7000.*

Circle 954 on reader service card

NEW

NetManage Brings SNMP to the Desktop



WHAT'S NEW? NetManage brings SNMP management functions to the desktop.

NetManage's NEWT TCP/IP stack and SNMP agent or other desktop SNMP agents) as well as network resources such as bridges, hubs, and routers.

• List price: *NEWTwatch, \$495. NetManage Inc., 20823 Stevens Creek Blvd., Cupertino, CA 95014; 408-973-7171; fax, 408-257-6405.*

Circle 955 on reader service card

NEW

Boca Research Joins the PCMCIA Market

Boca Research brings high-speed connectivity to your laptop or notebook with the introduction of its 14.4-kilobit-per-second (Kbps) PCMCIA modem. The M144PA is a PCMCIA Type II, Release 2.01 card that features automatic detection and handling of incoming data or fax calls, as well as auto-dial, auto-answer, and tone or pulse dialing. The PCMCIA modem supports the V.32bis, V.32, V.22bis, Bell 212A, and Bell 103 standards. Data compression speeds of 57.6 Kbps can be achieved with support for Microcom Network Protocol Class 5 and V.42bis.

Along with the new modem, Boca introduced a 10BaseT Ethernet PCMCIA adapter. The Type II card can operate at distances of up to 328 feet and features software driver support for NetWare 2.2, 3.11, and 4.0; LAN Manager; and Windows for Workgroups.

• List price: *Boca M144PA, \$369; Boca BEN1PA, \$229. Boca Research Inc., 6413 Congress Ave., Boca Raton, FL 33487-2841; 407-997-6227; fax, 407-997-0918.*

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BRIEFS

HUBS

Pilkington Communications Inc.

announced a stackable Ethernet hub that features eight fiber-optic ports and two twisted-pair ports. The MaxiHub 5032 (\$3,092 to \$3,796) also features two plug-in modules: one for network management and the other for either fiber-optic, thick coax/AUI, or thin coax. 914-683-3732.

D-Link Systems Inc.'s DE-1200 and DE-1600 manageable Ethernet hubs feature 12 10BaseT UTP ports as well as one AUI and one BNC port for connection to a network backbone. Up to five DE-1200 (\$945) and DE-1600 (\$1,495) hubs can be stacked for a total of 60 UTP ports. While SNMP management is built into the DE-1600, the DE-1200 can be upgraded by installing an SNMP slide-in module. 714-455-1688.

SWITCHES

U.S. West's Advanced Communications Services business unit announced a three-phase program outlining its plans to provide ATM over the next two years. Phase one involved the definition of its ATM architecture and the selection of Newbridge Networks as its ATM switch partner. Phase two details two customer application trials of ATM services, and phase three calls for the deployment of ATM services starting in the third quarter of 1994. 800-328-2879.

AT&T/NCR announced its ATM Technology Guarantee program for users of NCR's SmartHUB XE Ethernet hub who want to upgrade to the UniverCell family of ATM-based premises communications switches. The program promises that if an ATM upgrade is not delivered by the end of 1994, the company will issue a free upgrade or a check for \$5,000 (one per customer). 800-637-2600.

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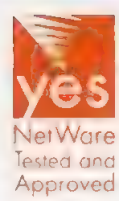
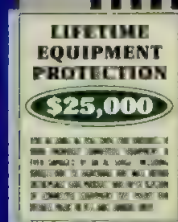
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Model	Application	Sugg. List
BK250	LAN nodes, internet hardware, POS	\$139
BK400	Desktop 486, 386 systems, servers	\$229
BK450	Tower 486, 386 systems, servers	\$279
BK600	Heavily configured systems, CAD/CAM workstations	\$399
BK900	Multiple systems, longer runtime applications	\$599
BK1250	Multiple systems, LAN hubs, small minis, telecom equipment	\$799

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NEW

Spry to Release DMTF Management Applications

Spry recently announced the upcoming release of applications for managing desktop systems, hardware and software components, and peripherals. The applications are compliant with the Desktop Management Task Force's Desktop Management Interface (DMI), which enables the management and integration of different network devices from different vendors. Personal ID is an asset management application for desktop inventory, and Registrar is an electronic product registration package.

Personal ID tracks an individual PC's hardware and software using a customizable asset management file. The application provides company-specific information such as user name, address, and company name. Registrar takes the information extracted using Personal ID and enables customers to register their hardware and software products electronically. The products, upgrades to Spry's AIR Series of terminal-emulation packages, will be released during the first quarter of 1994.

• *Personal ID and Registrar will be included in Spry's AIR Series. Spry Inc., 316 Occidental Ave. South, 2nd floor, Seattle, WA 98104; 206-447-0300; fax, 206-447-9008. Circle 957 on reader service card*

NEW

Fluke LANMeters Diagnose Your Ethernet LAN Troubles

Building on the success of its Fluke 670 Token-Ring LANMeter diagnostic tool, Fluke Corp. announced that it will add two new test tools to its brood. The Fluke 672 Ethernet LANMeter and the Fluke 675 Combo LANMeter are handheld devices designed to test and troubleshoot network problems. These test tools diagnose the network's most common problems and isolate faults on the physical media, adapter cards, and Multistation Access Units. Both tools' troubleshooting capabilities include LAN-At-A-Glance LEDs that offer instant information on network status, collision analysis, Novell and TCP/IP traffic analysis, and ExpertT Autotest, which can determine the presence of faults in the adapter, cable, or hub.

• List price: *Fluke 672 Ethernet LANMeter*, \$5,995; *Fluke 675 Combo LANMeter*, \$8,995. *Fluke Corp., P.O. Box 9090, Everett, WA 98206-9090; 800-443-5853, 206-347-6100; fax, 206-356-5116.*

Circle 958 on reader service card



WHAT'S UP, DOC? Fluke's LANMeters help you diagnose your network's problems.

NEW

Mountain Unveils Peer-to-Peer Backup System

Mountain Network Solutions unveiled its newest product, a backup/recovery system designed for users who have opted for a smaller, low-cost peer-to-peer network rather than a client/server environment. FileSafe for Windows Peer-to-Peer provides backup, data management, and disaster recovery for networks with less than 20 nodes. The package is currently available for Artisoft's LANtastic network operating system. The company plans to support Novell's Personal NetWare (the replacement for NetWare Lite) and Microsoft's Windows for Workgroups.

• List price: *FileSafe for Windows Peer-to-Peer*, \$249. *Mountain Network Solutions Inc., 360 El Pueblo Rd., Scotts Valley, CA 95066-4268; 408-438-6650; fax, 408-461-3047.*

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BRIEFS

BUSINESS NEWS

Chipcom and Artel Communications

will merge. Chipcom designs, manufactures, and markets fault-tolerant intelligent switching systems, including hubs and network management products. Artel is a leading Ethernet switch manufacturer. Chipcom also announced that it will sell Artel's Galactica product line. The merger will take effect in February. Chipcom Corp., 508-460-8900; Artel Communications Corp., 508-562-2100.

BBN and Ungermann-Bass Inc.

combined technologies to form a new ATM networking company, LightStream Corp. Combining expertise in both the LAN and WAN markets, LightStream Corp.'s first product to market, the LightStream 2010 switch (starting at \$25,000), provides a migration path to LAN and WAN integration using ATM technology. 408-496-0111.

Cisco Systems and Microsoft Corp.

signed an agreement to provide an integrated networking and communications solution. The agreement calls for Cisco to develop a PC-based router card for the Microsoft Windows NT Advanced Server operating system. Cisco Systems, 800-326-1941; Microsoft Corp., 206-882-8080.

Network General Corp.

announced a joint marketing agreement with Alantec, a vendor of intelligent switching hubs. The companies will team up to integrate network analysis and hub management. Users of Alantec's PowerHub family of hubs will be able to integrate Network General's Expert Analysis and protocol decode technology into their network management procedures for a global view of their network. Network General Corp., 415-473-2000; Alantec, 800-252-6832.

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Wireless Internetworking

Look up in the sky! It's a bird. It's a plane. No, it's a LAN. A *what?* Yes, a LAN. During the summer of 1993, a consortium of the biggest wireless cellular service providers, including McCaw, Southwestern Bell, BellSouth, and Pac Tel, developed a data-over-cellular standard called Cellular Digital Packet Data (CDPD). CDPD will essentially provide a LAN-like service over today's cellular networks, quadrupling the bandwidth offered by Ardis and RAM Mobile Data. At least, that's what proponents think. Given that pricing is unknown and bandwidth may be very limited, though, it's not clear whether CDPD will be the right choice for your company.

The most impressive part of CDPD is its use of IP and OSI's CLNP (Connectionless Network Protocol). The CDPD infrastructure uses the cellular systems to access a backbone of routers. For example, McCaw recently announced that it will be using Retix's RouterXchange Model 7000 routers as well as Retix's OSI application software (which includes X.400, X.500, and Common Management Information Protocol) within its nationwide CDPD service. PDAs, palmtops, and laptops running applications that use IP can connect to the CDPD service and gain access to other mobile computer users or to corporate computing resources that are locked into using wires.

The world of CDPD will be made up of some 12,000 trisectors in the U.S. and 1,500 in Canada. A trisector is a set of three cell sites, each with 19.2 Kbps of bandwidth (or 56 Kbps per trisector) available for CDPD services. For every 60 trisectors, there will be a router: a total of 225.

Relegating access will be an arbitration algorithm similar to the one used on Ethernet networks. Digital Sense Multiple Access (DSMA) allows multiple users to share a single cellular frequency but instead of handling 10 Mbps, as when it's used over Ethernet, it will handle 19.2 Kbps.

CDPD will also offer a connectionless datagram service. It will use the SubNetwork Dependent Convergence Protocol or SNDCP and a data-link protocol called Mobile Data Link Protocol (MDLP), which will give the user a direct connection to the router backbone. The MDLP uses MAC frames and sequence control to provide error detection and recovery, while the SNDCP provides segmentation, header compression, encryption, and authentication. The router network will provide key network attributes such as address resolution, roaming, intersector and intra-



CDPD will provide LAN-like service over today's cellular networks, quadrupling currently offered bandwidth.

sector routing, and interconnection into other networks such as a corporate internet, the Internet, or other on-line services. Therefore, the router backbone is the infrastructure in which to increase the range of available services.

Let's assume that you are using a CDPD network. The way the system is supposed to work is that when you power up your PDA, palmtop, or laptop, a registration process that plugs your device into the wireless LAN in the sky is initiated. Your wireless device is homed to a specific router, which keeps track of your location. All messages for you come to that router. When you move out of your home trisector, the home router forwards your packets to another router, which guides traffic within the group of trisectors you are in at that time. Therefore, true nomadic computing is provided.

This approach keeps routing updates to a minimum, since updates are performed when you move out of your home trisector, and allows you to roam from cell to cell or city to city. Once linked into the CDPD network, a wireless device contends for use of part of the 19.2-Kbps bandwidth much like a desktop contends for LAN bandwidth. For all this to happen, your mobile computer needs a CDPD wireless modem, a product that is just starting to become available from the likes of Apple and IBM with their Newton and ThinkPad 750, respectively. And with AT&T owning McCaw, look for the E0 440 to become CDPD-equipped.

But while CDPD has many exciting attributes, it also has many unknowns. Some of the biggest unknowns are the price points for CDPD modems and the wireless service traffic structure at large and the details of CDPD availability. The biggest difficulty is the small amount of bandwidth available to the wireless device. A cellular cell of 19.2 Kbps is just too small to be effective and useful. It may be fine for today's PDA market, but there are only some 10,000 PDAs on the streets. In large metro areas, where hundreds of thousands of wireless devices may be contending for 19.2 Kbps, waiting for the CDPD system to send or receive a fax, file, or e-mail to or from your mobile computer may leave you with that frustrating feeling of being left hanging in midair.

NICK LIPPIS is a contributing editor to *PC Magazine* and is president of Strategic Networks Consulting, a consultancy specializing in enterprise networking. He is also publisher of *The Internetwork Advisor*, a monthly newsletter.

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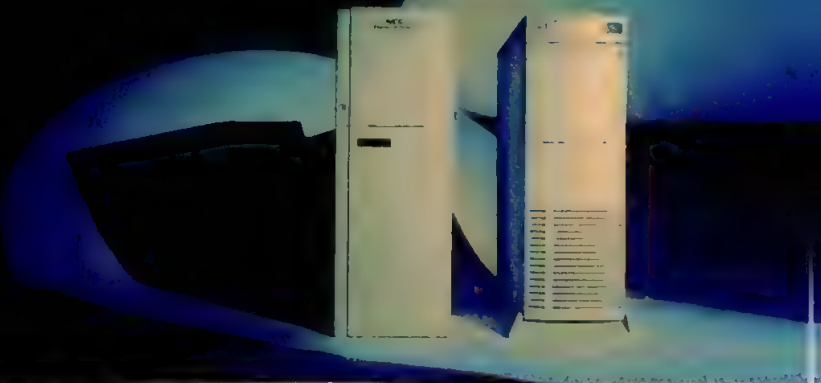


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100-Megabit Networking: Who Will Win?

David, we've compared the competition between the 100BaseX (Fast Ethernet) and 100VG-AnyLAN (100VG) fast networking standards to the struggle between the VHS and BetaMax videotape standards. In both battles, the competition between standards results in incompatible products, forcing you to choose which side of the fence you're on. Once you bet one way or the other, you're committed. But I'm ready to declare a winner in the race for 100-megabit LANs even before products for the fast networking standards come out: There is no doubt in my mind that the 100BaseX proposal sponsored by the Fast Ethernet Alliance will win right out of the starting gate.

Although 100VG, the alternative, is sponsored by Hewlett-Packard, AT&T, and IBM, its reliance on having four good pairs of unshielded twisted-pair wire going to every wall outlet is problematic. These great engineering companies—among the best in the business—have designed a four-engine airplane that can't fly on three!

The Fast Ethernet Alliance, which includes companies such as David Systems, Digital Equipment Corp., Grand Junction Networks, Intel Corp., National Semiconductor, Sun Microsystems, and 3Com Corp., has a standard that will work over two pairs of Category 5 UTP, IBM-style shielded twisted-pair, or optical fiber. The Alliance bowed to the competition and also included a method of using four pairs of lower-quality Category 3 10BaseT wiring. While I think the Alliance members should be ashamed of themselves for caving in, they have effectively walled off most of the marketing punch of 100VG. Hopefully, anyone who really needs fast networking will remember that your network is never any better than its cable system.

Because 100BaseX uses the standard CSMA/CD Ethernet media access control technology, lots of people know how to write the code to make it work. Products that work together will slide out of many companies on a bed of Intel or National Semiconductor silicon. Ethernet is the stuff I trust when I want an easy, compatible, and reliable installation.

David, before you start laying out money for any 100-megabit networking scheme, remember that you can gain a lot of throughput and reliability by segmenting your network using multiple adapters in the server or by using an Ethernet switch.



DERFLER:

The 100BaseX proposal sponsored by the Fast Ethernet Alliance will win right out of the starting gate.

There you go again, Frank—oversimplifying a complex argument. The dispute between Fast Ethernet and 100VG has got zilch to do with BetaMax and VHS. In that situation, only one standard survived. Here, as with Ethernet and Token-Ring, they will coexist. And given that both camps project roughly the same price points for network connections and delivery schedules, the important question is: Which is technically the better choice?



GREENFIELD:

100VG will support more users on a single segment and carry voice, video, Ethernet, and Token-Ring traffic.

The answer is clear: 100VG. It will support more users on a single segment than will Fast Ethernet. And unlike Fast Ethernet, it will also carry voice and video traffic, not to mention Ethernet and Token-Ring traffic.

And 100VG is designed for UTP. By contrast, Fast Ethernet has been patched to run over UTP. Sure, Fast Ethernet can run over two pairs of Category 3 cable, but at 50 MHz, that cable is going to radiate like a California brush fire.

There's also a split in the Fast Ethernet group over the support of Category 5 (data-grade) and Category 3 (voice-grade) cabling. Eventually, there will be negotiations, but currently there is no consensus around this very basic point.

Frank, you can talk all you want about how LAN managers who know how to design and install Ethernet will know how to build, design, and install Fast Ethernet products. But there are real problems with that argument. First of all, Fast Ethernet will employ the cabling interface of FDDI—not of Ethernet.

Second, there could be some real problems with characteristics of an Ethernet segment stretched to its maximum limit. Currently, users are experienced in running Ethernet well within Ethernet's 2,500-meter limit. Most installations operate less than 100 meters from the wiring closet. Fast Ethernet can only run up to 250 meters. Thus, many Fast Ethernet networks will function right near the maximum length (100 meters from the sending client to wiring closet and then 100 meters from the hub to the receiving server).

In truth, Frank, both Fast Ethernet and 100VG have enough support to find markets. Vendors will quickly learn that giving customers the choice of standards will be more profitable. As users struggle in the short term to choose a specification to standardize on, ask yourself: Do you really want a specification kludged to run over UTP or one optimized for it?

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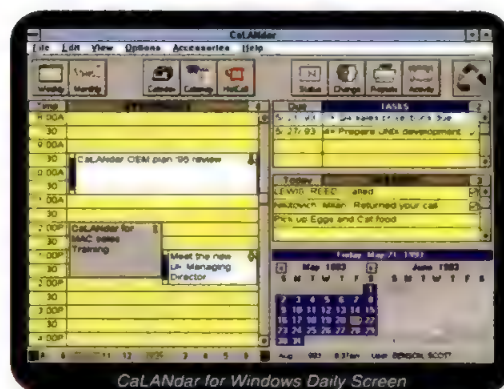
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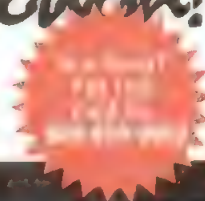
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User-to-User

BY NEIL J. RUBENKING

Change Drive and Directory with a Single Command

I finally figured out how to change to a new drive *and* directory from within a batch file. I've used several .COM or .EXE programs for this purpose, but doing it with only a batch file was a challenge. In the User-to-User column in the April 13, 1993 issue, I found a technique that provided the solution. The batch file in Figure 1 is the result. The syntax is

```
CDD [drive:][path]
```

with no space between the drive letter and the path. Just use it as you would the DOS CD command. The batch file will switch to the specified directory *and* change drives if the path includes a drive letter.

The batch file relies on the FOR command's special treatment of the slash character (/). When an item in the set is preceded by a slash, FOR treats it as two items, the first character and the remainder. For example, the command

```
FOR %%a IN (/data) DO ECHO %%a
```

will display d and ata. CDD.BAT uses this trick to strip off the drive letter and

check that the second character is a colon. By the way, my DOS manual doesn't mention anything about using the slash with the FOR command. Where do people learn these things? I've been trying to do this for a year!

M. Scott Reynolds
West Valley City, Utah

► **PC MAGAZINE:** Just to review, the syntax for the FOR command is

```
FOR variable IN (list) DO action
```

When FOR is used at the DOS prompt, the variable is a single letter preceded by a percent sign; within a batch file, the letter is preceded by two percent signs. The list portion is a series of text strings or file specifications, and the action portion

is a DOS command that may also include the FOR variable. FOR will execute the action portion once for each item in the list. If an item is a file specification, FOR executes the action for each matching file.

An item that begins with a slash is processed as *two* items by the FOR command—the first letter and all the rest. This behavior isn't documented, but it can be very useful. Note that some non-Microsoft DOS packages don't emulate this behavior.

To get the remainder of a string using FOR, just have the action portion of the command set an environment variable to the FOR variable. For example:

```
FOR %%a IN (/bear) DO SET evar=%%a
```

The action portion sets the environment variable *evar* to b and then to ear; *evar* retains the second value.

To test for a particular first character, compare the FOR variable with the desired character and jump to a label if they match. For example:

```
FOR %%a IN (/bear) DO IF '%%a'=='b'  
GOTOIsB
```

It doesn't matter that the IF test is false the second time around. The GOTO command will take effect if the test is true for either value of the FOR variable.

In order to get the first character of the string, reexecute the batch file in the action portion of the FOR command, passing the FOR variable as a parameter. This transfers control to a new copy of the batch file immediately, without processing the remainder of the split string. For example:

```
FOR %%a IN (/bear) DO %0 %%a
```

The parameter %0 contains the name of the current batch file, so this line re-executes the batch file passing b as a parameter.

► IN THIS SECTION

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You'll find both of these techniques used in CDD.BAT. I've actually written a batch file with the same name and purpose for my book *PC Magazine DOS Batch File Lab Notes*. The batch file you see in Figure 1 is a hybrid, combining the best points of both versions. This batch file uses the FOR command's quirk to get the drive letter of a full pathname and to verify that the second character is a colon. Try tracing through it to see how the technique works, and consider how you can use it in your own batch files!

You can download CDD.BAT from PC MagNet's Utilities/Tips forum.

SLOWING THE BOOT PROCESS

With the push today for faster and faster machines, the one complaint you'd never expect to hear is "My machine is too fast!" However, while acting as sysop in various ZiffNet forums, I've encountered numerous messages from folks whose machines are indeed too fast. The problem is that the machines boot so quickly that the peripherals don't have time to initialize before the machine tries to access them. Thus, the users have to boot their machines a second time to get everything working.

There are a number of CONFIG.SYS pause utilities available, but all of them require a keystroke either to engage the pause, continue after the pause, or both. Since users wanted something that would delay the boot process without requiring a keystroke, I wrote SLOWIT.SYS, a device driver that simply wastes time and then uninstalls itself.

Figure 2 is SLOWIT.SCR, a DEBUG script to create SLOWIT.SYS. Use the following command in order to create SLOWIT.SYS:

```
DEBUG < SLOWIT.SCR > SLOWIT.TXT
```

Take a look at SLOWIT.TXT to make sure no errors occurred during the process. Then add the line

```
DEVICE=d:\path\SLOWIT.SYS
```

to your CONFIG.SYS file. Usually it will be the first line, though you can place SLOWIT.SYS elsewhere in the file.

It's important to note that, because SLOWIT uses a delay loop, the length of the delay will vary depending on the speed of your machine. If you need to change the delay, modify the indicated line in SLOWIT.SCR. To double the de-

lay, double the number, and so forth. Be careful, because too large a value will cause a very long delay, up to 20 minutes on a 40-MHz 80386 or up to 3.5 hours on a 4.77-MHz XT! Also note that replacing the number with zero produces the longest possible delay.

You can also use SLOWIT as a diagnostic tool. Just place its DEVICE= line after any other DEVICE= statement to

*With the push
today for faster
and faster machines,
the one complaint
you'd never expect
to hear is "My machine
is too fast!"*

.....

give you time to read the other driver's screen output. You can use SLOWIT.SYS as many times as you want without consuming any memory. It will work properly if loaded with DEVICE HIGH=, but since it doesn't remain in RAM, there's no reason to do so.

The key items in the values at the start of the driver are the offsets to the strategy and interrupt routines. DOS uses these offsets to access the device driver after loading it into memory. When DOS accesses a device driver, it begins by assembling a data structure called a request packet. The request packet contains information indicating the length of the packet, the type of request, and any other information the driver requires to carry out the request. It also provides the device driver with a place to return information to DOS after performing the desired function. DOS puts the address of the request packet into the ES:BX registers then performs a far call to the driver's strategy routine.

The strategy routine is responsible for processing the request packet to determine the type of request and prepare the information (if any) contained in the packet for use by the driver's interrupt

CDD.BAT Complete Listing

```
@ECHO OFF
IF '%1'=='' GOTO usage
IF '%2'=='/chg_drv' GOTO chg_drv
REM ---- Set var & to remainder of first parameter
FOR %%a IN (%1) DO SET &=%%a
REM ---- If first char of var is colon, jump to has_colon
FOR %%a IN (%&) DO IF '%%a'==':' GOTO has_colon
REM ---- If no colon, it's an ordinary directory
GOTO chg_drv

:has_colon
REM ---- Re-execute passing original first parameter, special
REM ---- switch /chg_drv, and drive letter plus colon
FOR %%a IN (%1) DO %0 %1 /chg_drv %%a:

:usage
ECHO CDD.BAT - Changes the current drive and directory
ECHO.
ECHO Usage: CDD [drive:]path
ECHO.
GOTO end

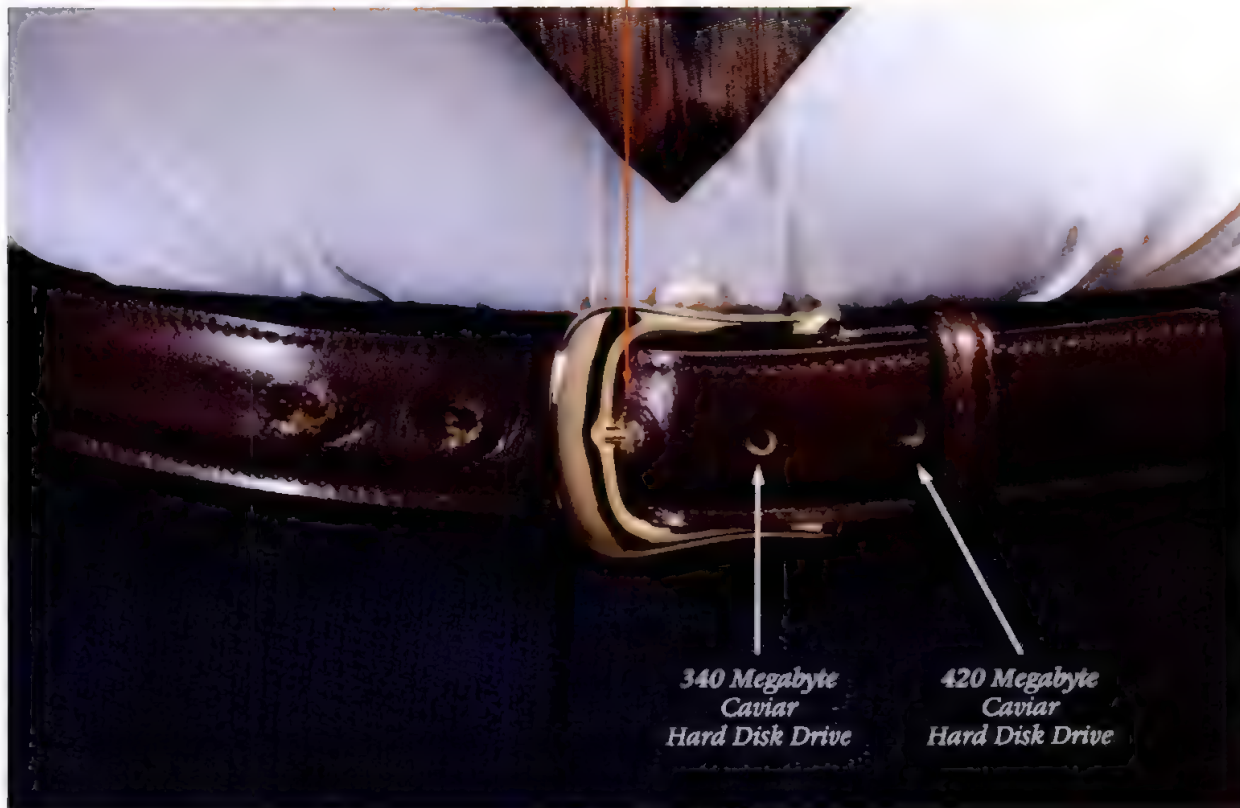
:chg_drv
SET &=
REM ---- Change drive (does nothing if there was no colon)
%3
REM ---- Change directory (does nothing if no directory)
IF NOT '%1'=='%3' CD %1

:end
```

Figure 1: CDD.BAT goes the CD command one better—it changes directory and drive in one step.



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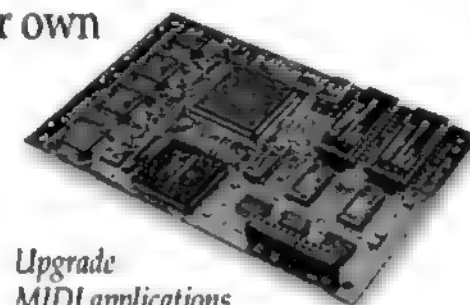


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Wave Blaster Upgradability	Yes	Yes	Yes
CD-ROM Compatibility	Creative Labs/Panasonic	Sony, Mitsumi, Creative Labs/Panasonic	Any SCSI or SCSI 2
Bundled Hardware		Microphone	Microphone
Bundled Software	Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic	Software Toolworks Multimedia Encyclopedia HSC InterActive SE PC Animate Plus Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic Creative VoiceAssist	Software Toolworks Multimedia Encyclopedia HSC InterActive SE PC Animate Plus Monologue for Windows Creative WaveStudio Creative Soundo'LE Creative Talking Scheduler Creative Mosaic Creative VoiceAssist
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THE 16-BIT SOUND STANDARD.

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routine. After the strategy routine finishes processing the data, it returns to DOS. DOS then immediately performs a far call to the interrupt routine, which does the actual work.

SLOWIT.SYS is a quick and dirty solution and takes a couple of shortcuts. One of these shortcuts takes advantage of the fact that when DOS first loads a device driver into memory, DOS immediately calls the driver with an INIT request. This is the *only* type of request that SLOWIT will ever see, so the strategy routine just stores the address of the re-

quest packet for use by the interrupt routine. When the strategy routine finishes, it returns to DOS, which immediately calls the interrupt routine. The interrupt routine executes a nested loop that does the actual work of wasting time.

After the delay loop is finished, SLOWIT takes another shortcut. A device driver's INIT routine is responsible for telling DOS how much memory the driver requires. It does so by storing the desired ending address in the request packet. Since there's no need for SLOWIT to remain in memory after do-

ing its job, SLOWIT stores its own *beginning* address instead of its ending address. When DOS sees that SLOWIT's starting and ending addresses are the same, it responds by removing SLOWIT from the device driver chain.

*Greg Wolking
via ZiffNet*

► **PC MAGAZINE:** SLOWIT.SYS may seem unusual, but it isn't the first non-resident device driver to be featured in User-to-User. One of the first was DUMMY.SYS, a do-nothing device

driver that served as a placeholder for the *PC Magazine* utility CONFIG.CTL. Another was ALTPAUSE.SYS, built by a reader to pause the execution of CONFIG.SYS for as long as any Shift key was held down. Like SLOWIT.SYS, these device drivers do all their work while processing the INIT request and then bow out by requesting *no* memory for themselves.

Before using SLOWIT.SYS or *any* unfamiliar device driver for the first time, make sure you're prepared in case it's incompatible with your system. Format a floppy disk with the /S (for System) option and copy any necessary drivers to it. Test the boot floppy by booting your system from it, then put it in a safe place. Now if a new device driver locks up your system, you can reboot using the boot disk.

If you use DOS 6.x, you don't have to prepare a boot floppy. Reboot the computer, and watch for the words "Starting MS-DOS..." to appear on the screen. Now press F5 to totally skip processing CONFIG.SYS and AUTOEXEC.BAT, or press F8 to select which CONFIG.SYS lines to execute. Once your system's up and running, you can edit CONFIG.SYS to remove the offending line.

You can download SLOWIT.SYS and its DEBUG script from PC MagNet's Utilities/Tips forum archived as SLOWIT.ZIP. □

SLOWIT.SCR Complete Listing

```

N SLOWIT.SYS
A 100
;Device driver header starts with a "dummy" pointer
DW FFFF
;to the next driver in the chain.
DW FFFF
;Set device attributes to indicate a character device.
DW 8000
;Offset to device "strategy" routine.
DW 0016
;Offset to device "interrupt" routine.
DW 001F
;Device name (must be 8 characters).
DB 'SLOWIT'
;Storage for pointer to interrupt request packet
DW 0
;(two words required for segment and offset).
DW 0
MOV [0012],ES ;Driver "strategy" routine -- save request packet address
MOV [0014],BX ;which DOS puts into ES:BX before calling this routine.
RETF          ;Return to DOS, which then calls the "interrupt" routine.
PUSH AX      ;Interrupt routine begins here; the first step is to
PUSH CX      ;save all registers on the stack that will be modified.
PUSH DX
PUSH ES
PUSH DI
;****
MOV CX,0200  ;The next line initializes the outer delay loop counter;
;change the "0200" in this line to alter the delay factor.
;****
MOV DX,CX    ;Save outer loop counter in DX.
MOV CX,0     ;Initialize inner loop counter (CX).
LOOP 012C    ;Waste time by decrementing CX until it reaches zero.
MOV CX,DX    ;Restore outer loop counter from DX to CX.
LOOP 0127    ;Decrement outer loop counter; repeat until it's zero.
CLD         ;Now, set the driver's size. Begin by loading the request
MOV ES,[0012] ;packet's address into ES:DI, then point DI to the offset
MOV DI,[0014] ;within the packet where the driver's ending address is
ADD DI,0E    ;stored.
MOV AX,0000  ;Store offset of beginning of driver.
STOSW
MOV AX,CS    ;Store segment of beginning of driver.
STOSW
POP DI       ;Restore registers from the stack.
POP ES
POP DX
POP CX
POP AX
RETF        ;Return to DOS.

RCX
EB
W
Q

```

Figure 2: This DEBUG script creates SLOWIT.SYS, a nonresident device driver that, when installed in your CONFIG.SYS file, slows down the boot process in PCs that boot too fast for their peripherals.



Tutor

BY JEFF PROSISE

Empowering Physically Challenged Users

How easy it is to take life for granted. For most of us, typing a letter in a word processor or entering a few numbers into a spreadsheet is something that requires little thought and no more than a few moments of our time. For a significant number of *PC Magazine* readers, however, everyday computing chores such as these require painstaking effort and a great quantity of time. Imagine placing a stick in your mouth and typing a five-page report with it. That's how a physically challenged user lacking the use of his arms must type. And imagine what an obstacle key combinations such as Shift-F7 (WordPerfect's Print key combination) would be if you were physically unable to press more than one key at a time.

Problems such as these confront thousands of handicapped computer users every day. The focus of this column is PC aids for physically challenged users—programs and devices specifically designed to make computing easier for users with limited motor control. We'll also look at three helpful utility packs from Microsoft and IBM geared for DOS, Windows, and OS/2 users.

STICKY KEYS AND TYPOMATIC REPEAT

Several years ago, *PC Magazine* published a utility called STAYDOWN, which I wrote in response to a letter from the director of handicapped computing services at a small college in New York. STAYDOWN adds a sticky key feature to PCs, enabling key combinations such

as Alt-F to be entered by pressing the Alt key followed by F. These key combinations are no problem for most of us, but for a physically disadvantaged person using a mouth stick, they are impossible. Utilities such as STAYDOWN break down one of the greatest obstacles confronting handicapped users hampered by limited motor control. You can download STAYDOWN from Library 2 of PC Magnet's Utilities/Tips forum (look for the file STAYDN.COM). Or you can send your request for the utility to Public Brand Software, P.O. Box 51315, Indianapolis, IN 46251; fax 317-856-2086. Be sure to specify a return address and the desired disk size and capacity.

Concurrent keystrokes aren't the only problem facing handicapped computer users. I recently received this letter from Michael J. Walsh of Oak Park, Michigan:

My wife is a cerebral palsy quadriplegic. She uses your STAYDOWN program with her word processor. She finds it invaluable, because she uses a stick to depress keys. But one of the problems she is still confronted with is that when a key is held down for more than a fraction of a second, it repeats itself. Quite

often she cannot press and release the key quickly enough to prevent the character from repeating. Is it possible to disable the keyboard's automatic repeat feature for the benefit of users like my wife?

The "repeat" that Mr. Walsh refers to is, of course, the keyboard's built-in typematic repeat. Press and hold a key, and after a short pause the key will begin to repeat as if you were pressing and releasing it repeatedly. This repeat is handled in hardware, and it has been a feature of IBM PC keyboards since day one.

There are at least two ways to override typematic repeat. One uses the tools that DOS provides. The other uses a custom utility that you can create with DEBUG.

The first solution involves a little-used feature of the MODE command. It requires DOS 4.0 or later and also requires a 286 or better computer. It will work on just about any PC purchased in the last five or six years, but it will not work on early-

1980s PC- and XT-class machines. Since DOS 4.0, the MODE command has supported RATE and DELAY switches allowing you to reprogram the typematic rate (the rate at which characters repeat when a key is held down) and delay (the amount of time before typematic repeat begins after the key is pressed) on AT and Enhanced keyboards. Valid values

For a small but significant number of PC Magazine readers, everyday computing chores require painstaking effort and a great quantity of time.

for RATE range from 1 to 32, corresponding to approximately 2 to 30 characters per second. Valid values for DELAY range from 1 to 4, where 1 equals .25 second, 2 equals .5 second, 3 equals .75 second, and 4 equals 1.0 second. The command

MODE CON: RATE=32 DELAY=1

selects the highest possible repeat rate and the shortest possible delay (which will really juice up your keyboard), while the command

MODE CON: RATE=1 DELAY=4

NOREPEAT.SCR

Complete Listing

```

A      0100
JMP    0130      ;Jump to INIT
DB     0,0,0,0,70
STI     ;Interrupts on
PUSH    AX      ;Save AX
IN      AL,60    ;Read scan code
CS:     ;
CMP     AL,[0106] ;Identical to last scan code?
JE      011D     ;Yes, then branch to RESET
CS:     ;
MOV     [0106],AL ;Store scan code for next time
POP     AX      ;Restore AX
CLI     ;Interrupts off
ESI     ;
JMP     FAR [0102] ;Jump to keyboard BIOS
IN      AL,61    ;RESET: Reset the keyboard
MOV     AH,AL    ;controller (ignore the scan
OR      AL,80    ;code)
OUT     61,AL
MOV     AL,AH
OUT     61,AL
      
```

```

CLI     ;Interrupts off
MOV     AL,20    ;Signal end-of-interrupt to
OUT     20,AL    ;the interrupt controller
POP     AX      ;Restore AX
IRET     ;Return from interrupt
MOV     AX,3509   ;INIT: Get current interrupt
INT     21       ;$9h vector
MOV     [0102],BX ;Save it
MOV     [0104],ES
MOV     AX,2509   ;Point interrupt $9h to our
MOV     DX,0107   ;own interrupt handler (above)
INT     21
MOV     DX,0130   ;Terminate and stay resident
INT     27

M NOREPEAT.COM
RCX
4A
W
Q
      
```



Figure 1: This DEBUG script creates a program that will prevent your PC from repeating a character when you hold down a key.

selects the slowest possible repeat rate and the longest possible delay. While the MODE command cannot be used to disable typematic repeat entirely, setting DELAY to 4 allows you roughly twice as long (1 second) to release a key as the default power-up configuration, which has the keyboard begin repeating characters after only .5 second.

A second solution to the problem of typematic repeat comes in the form of a small utility, NOREPEAT.COM, which you can create with DEBUG. When executed, NOREPEAT disables typematic repeat entirely, and it works on all PCs. The DEBUG script for creating NOREPEAT.COM is listed in Figure 1. (You can download NOREPEAT and its DEBUG script from PC MagNet, archived as NOREPE.ZIP.) Start DEBUG and enter the script exactly as shown, with one exception: You need not enter the comments (the text following the semicolons). The comments were included only for instructional purposes. Be sure, however, to include the blank line near the end of the listing between INT 27 and N NOREPEAT.COM. NOREPEAT works by becoming resident in memory and setting up its own interrupt handler to process keyboard interrupts, which are generated every time a key is pressed or released. The interrupt handler reads the scan code identifying the key that was just pressed and "eats" the key—that is, hides it from the keyboard BIOS—if its value is the same as that of the previous scan code. Scan codes are hidden by resetting the keyboard controller and returning from interrupt without chaining the inter-

rupt to the keyboard BIOS. The controller reset isn't necessary on modern-day PCs, but old PCs and XTs will freeze up if the reset isn't performed.

THE MICROSOFT ACCESS PACKS STAY-DOWN and NOREPEAT are useful, but for some users they don't go far enough. For example, some handicapped users have a tendency to bounce keys—press a key twice when they meant to press it once. Another common problem is keys that are struck by accident. Usually these keys are depressed for only a fraction of a second, but even that is long enough to register a keystroke.

Microsoft offers a more comprehensive solution to the special needs of handicapped users in the form of AccessDOS. AccessDOS is distributed on the MS-DOS 6.x Supplemental Disk, which can be ordered for \$5 using the coupon in the back of the MS-DOS 6.x manual or downloaded for no charge (other than connect charges) from Microsoft's MS-DOS forum on CompuServe or the Microsoft Download Service (206-936-6735). AccessDOS is a TSR that offers eight basic services:

- A StickyKeys feature allows keystroke combinations to be entered one key at a time.
- A MouseKeys feature allows the keyboard to stand in for the mouse. With MouseKeys active, you can move the mouse pointer and simulate clicks of the mouse buttons from your keyboard's numeric keypad.
- A RepeatKeys feature allows you to adjust the typematic rate and delay interval, or to disable typematic repeat.

- A SlowKeys feature programs your PC to ignore a keystroke if the key was depressed for less than a specified period of time. This is one way to eliminate the accidental keystrokes that occur when the user moves from one key to another and brushes an intervening key along the way.
- A BounceKeys feature is designed to eliminate repetitive keystrokes due to bouncing. In essence, BounceKeys tells your computer, "Don't accept two successive presses of the same key unless a specified period of time passes between presses."
- A SerialKeys feature allows the keyboard to be driven by alternate input devices (for example, electronic communication aids) attached to a serial port.
- A ToggleKeys feature for visually impaired users provides an audible notification when a CapsLock, NumLock, or ScrollLock key is toggled on or off.

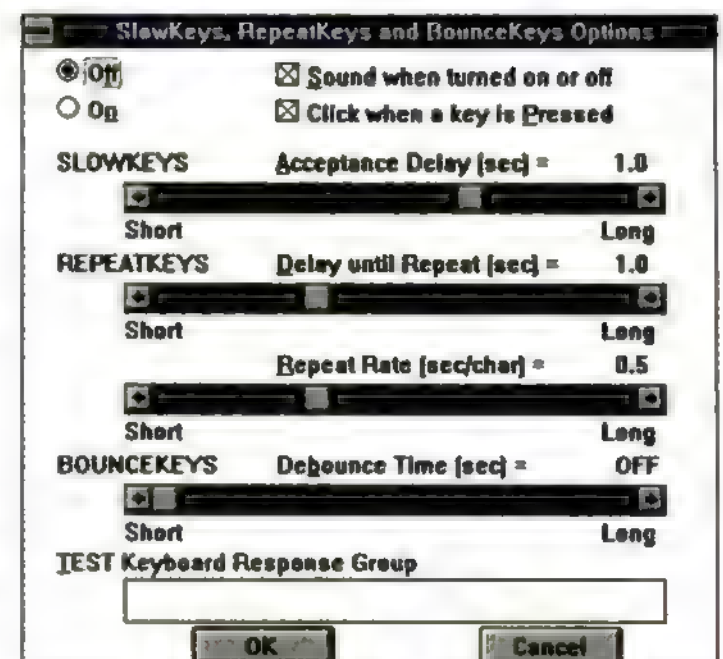


Figure 2: This dialog box lets you adjust Access Pack for Windows' SlowKeys, RepeatKeys, and BounceKeys features. Similar dialogs are provided for other Access Pack options.

• A ShowSounds feature for hearing-impaired users provides a visual notification when the PC beeps.

Option settings can be adjusted to suit the needs of individual users. For example, SlowKeys' acceptance delay time (the length of time a key must be held down before it is registered as a keystroke) can be adjusted from 0.3 seconds to 2.0 seconds, or it can be disabled entirely.

Unfortunately, DOS utilities such as these have no effect on Windows applications, primarily because Windows supplies its own keyboard driver, which overrides the custom keyboard handlers that AccessDOS and other similar programs install. To help, Microsoft makes a product called Access Pack for Microsoft Windows available free of charge. This product can be downloaded from CompuServe or the Microsoft Download Service. Users without modems can obtain copies by calling Microsoft Product Support Services at 206-637-7098. Access Pack brings the same basic enhancements to Windows that AccessDOS brings to

DOS. Both, in fact, were written by researchers at the University of Wisconsin's Trace Research and Development Center and made available to the public as a service (development was partially funded by a grant from IBM and the National Institute on Disability and Rehabilitation Research). Figure 2 shows the dialog box that Access Pack provides for adjusting the SlowKeys, RepeatKeys, and BounceKeys settings.

BUILT-IN HELP FOR OS/2 USERS If you're an OS/2 user, you don't need add-on software products to configure a PC for use by a handicapped person. OS/2 has many of the features of Access Pack built in. Click the right mouse button over the desktop, choose System Setup, then Keyboard, and then click on the Special Needs tab. Among the things you can do with Special Needs, you can enable sticky keys, specify a minimum keystroke acceptance time, alter the typematic rate and delay interval, and disable typematic repeat altogether. Even the default system colors were selected with special needs in mind. One rationale behind the

selection of OS/2's much-criticized color scheme was that it provides suitable contrast for color-blind users.

SPEECH! SPEECH! Speech-recognition products such as Covox Voice Blaster can be a tremendous help to physically challenged people. Covox Voice Blaster attaches to a Covox Sound Blaster or Sound Blaster Pro sound board and allows spoken commands to replace typed or mouse-entered commands. It works with DOS and Windows 3.1. None of the current crop of PC speech-recognition products are perfect, but they're light-years beyond where they were just a few years ago. For more information on Covox Voice Blaster, contact Covox at 503-342-1271.

Why do I spend a whole column discussing these products? Because they seem to be among the computing world's best-kept secrets. Very few physically challenged users who I meet or receive letters from are aware that AccessDOS, Access Pack, and the OS/2 Special Needs feature are available. If you know a handicapped user, spread the word. □

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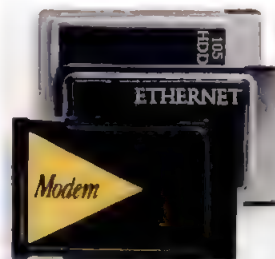
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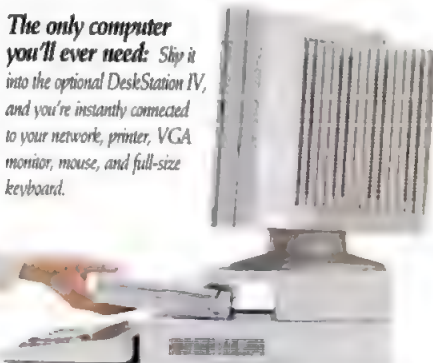
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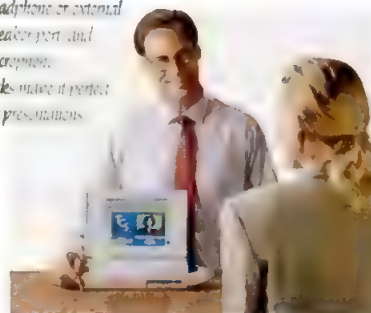
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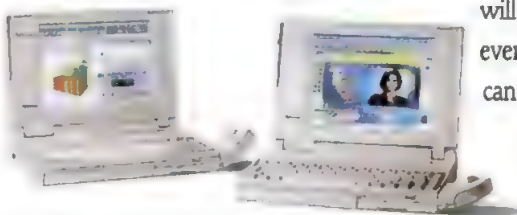
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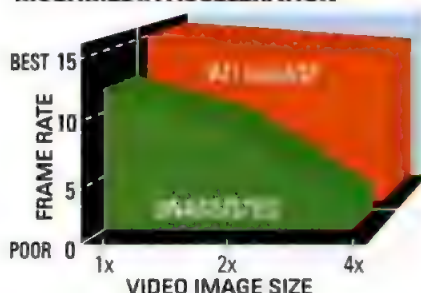
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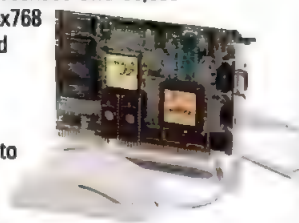
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Corporate Developer

BY SAL RICCIARDI

Introduction to Logical Database Design

Database design is the subject of many books and articles and the focus of much arduous study. The reason is compelling—an incorrect design can result in a system that fails to meet its users' needs, often requiring costly repairs or a complete redesign. The time you spend studying and applying principles of good database design is always time well spent.

Even before you create a database or enter the first piece of information, you must provide your DBMS with its logical structure in terms of tables (collections of information about a particular topic) and columns (specific items within a table). Let's consider a simplified database for the fictional Sam's Bookstop bookstore. The book database is used to track information—titles, author names, publisher information, inventory on hand—for all of the books that Sam's Bookstop sells.

DATABASE DESIGN Good database design consists of the following steps:

1. Write down the purpose of the database to better prepare yourself for the remaining steps.
2. Round up the information required. Gather all of the types of information you want to store in the database, such as the book title and publication date. Think about the types of reports and other output listings you need and then list those data items that appear on reports.
3. Divide the information into tables. Choose the major entities, or subjects,

from the information recorded in step two and then group the information items by subject. Write down the purpose of each table.

4. Turn the information items into columns. Take the information from step three and divide it into the proper columns. For example, divide Name into First Name and Last Name. Then choose a primary key for each table (discussed below).

5. The final step is to refine your design. For example, you might need to add a column you forgot to include earlier or split a table in two. As part of this process, you'll set up relationships between data tables and apply the data normalization rules to ensure a correct design. This topic is important enough to warrant more coverage in a future Corporate Developer. In the meantime, let's look at each of the first four steps in detail.

SPECIFYING THE PURPOSE It's a good idea to write down a paragraph that states the purpose of the database. It will serve as a reminder as you complete the design process. For example, the purpose of the Sam's Bookstop book database is to track information about book titles and inventory levels in order to better answer customer queries and create management reports.

For a large database that will be used by many people, the statement should be more elaborate and include when and how each person will use the database. The goal is to articulate a statement that you should refer to from time to time during the design process.

FINDING AND ORGANIZING INFORMATION

To find and organize the information required, think about the types of reports and listings you want to produce from the database, then list the items that should appear on the reports. For example, if you're Sam, you'll need to produce reports that show books by author or by publisher. Each report would contain the book title, ISBN (International Standard Book Number), publisher name, and author name. Planning the desired reports and listings helps you decide which items must be included in the database.

Next consider the information you currently record manually—on index cards, say, or forms—and list those items too. For example, you might currently re-

cord book sales or inventory information in a ledger or on sheets of paper that are stored in a file cabinet.

Also think about the questions you might need answered and what information would be required to answer them. This includes questions like "Do we have *To Kill a Mockingbird* in

stock?" or "What titles by Ayn Rand do we carry?" Anticipating questions like these will help you decide which additional items to record. List all of the individual information items that come to mind. At this point, you have a list of column candidates. The next task is to group the information into tables.

DIVIDING THE INFORMATION INTO TABLES

To select the tables, you divide the information into major entities, or subjects. For example, in researching the facts to be recorded in the book database, the preliminary list might look something like this:

Book title

An incorrect design can result in a system that fails to meet its users' needs, often requiring costly repairs or a complete redesign.

Book ISBN number
Book publication date
Book suggested retail price
Author name
Publisher name
Publisher address

The major entities shown here are the books themselves, the authors of the books, and the publishers of the books. So it makes sense to start out with three tables: one for facts about books, one for facts about authors, and one for facts about publishers, as shown below.

Book table:

Title
ISBN
Publication date
Suggested retail price

Author table:

Name

Publisher table:

Name
Address

When you first review the preliminary list, you might be tempted to place all the items into a single table instead of into the three tables shown above. Let's examine why that would be a bad idea. Consider for a moment the table shown in Figure 1.

In this case, each book record contains information about the book as well as the publisher. Because you can have many books from the same publisher, the publisher name and address information has to be repeated many times. The resultant duplicate information wastes a lot of hard disk space. Recording the publisher information only once in a separate table and then linking that table to the book table is a much more economical solution to the problem.

A second problem with this design comes about when you need to modify information about the publisher. For example, suppose you need to change the publisher address. Because it appears in many places, you might accidentally change the address in one place but forget to change it in other places (this is demonstrated by the two different addresses for Microsoft Press shown in

Figure 1). Recording the publisher's address in only one place effectively solves the problem.

When designing your database, always strive to record each fact just once. If you find yourself repeating the same information in more than one place, such as the address for a particular publisher, place that information in a separate table.

Finally, suppose that the fourth book shown in Figure 1, *A Farewell To Arms*, is the only book in the Sam's Bookstop inventory published by Charles Scribner's Sons. Suppose also that you

*Every row in a table
should contain a unique
identifier—a value
that distinguishes that
row from every
other row in the table.*

want to delete the book from inventory but want to retain the publisher name and address information. How would you delete the book record without also losing the publisher information? You can't. Because each record contains facts about a book as well as facts about a publisher, you cannot delete one without deleting the other. In order to keep these facts separate, you have to split the table in two: one table for book information and another table for publisher information. Deleting a book record should delete only the facts about the book, not the facts about the publisher.

Here's a good rule of thumb for database tables: Once you have chosen the subject represented by a table, columns in that table should only store facts about

the subject. For instance, the book table should store facts about books. Because the publisher address is a fact about the publisher, not a fact about the book, it belongs in the publisher table.

REFINING COLUMNS Once you have the information grouped into tables, you can further refine the columns. For example, storing the author's name as two separate columns makes sense: first name and last name, so that you can sort, search, and index on just those columns. Similarly, the publisher address actually consists of four separate components, address, city, state, and ZIP or postal code, and it makes sense to store them in separate columns too.

Once you've refined the data columns in each table, you're ready to choose each table's primary key.

PRIMARY KEYS In the relational model, tables are, by definition, unordered. As a result, there is no system-defined way to access a specific row through external means, such as by record number or row position. Instead, you identify a particular row by specifying a value contained in one or more of the row's columns. It follows that for the system to retrieve a particular row, the value used must uniquely identify that row as distinct from all others.

Every row in a table should contain a unique identifier—a value that distinguishes that row from every other row in the table. Sometimes a column stands out as an obvious candidate for unique ID; a unique employee identification number serves the purpose well, for example. In other tables, a combination of several columns might be required to uniquely identify each row.

The column (or combination of columns) that uniquely identifies each row is called the primary key. More than one column could potentially serve as a primary key, and each of these possibilities is called a candidate key. Although a ta-

BOOK TABLE		
Title	Publisher	Publisher Address
Programming Windows, 3rd ed.	Microsoft Press	One Microsoft Way
Word for Windows 2.0 Macros	Microsoft Press	One Microsoft Way
The Microsoft Guide to C++ Programming	Microsoft Press	10611 NE 36th Way
A Farewell To Arms	Charles Scribner's Sons	866 Third Avenue

Figure 1: Designing the book table this way results in duplicated information or accidental deletions, since removing a book record deletes the publisher information too.

BOOK DATABASE**BOOK**

BookID (PK) : 000030
 Title : Programming Windows, 3rd ed.
 ISBN : 1-55615-395-3
 Pubdate : 11/1/92
 SRP : 29.95

AUTHOR

AuthID (PK) : 000006
 Last : Petzold
 First : Charles

PUBLISHER

PubID (PK) : 000001
 Name : Microsoft Press
 Address : One Microsoft Way
 City : Redmond
 State : WA
 ZIP : 98052

Figure 2: The three tables used so far in the Sam's Bookshop book database, with sample data.

ble can have many candidate keys, it must have only one primary key. Those candidate keys not chosen as primary key are called alternate keys. When a combination of columns is used as the primary key, it is also called a composite key.

A good primary key has certain characteristics. Each instance must be unique in order to differentiate each row in the table. The primary key must always have a value. If a column's value becomes unassigned or unknown (a missing value) at some point, it can't be used as a component in a primary key.

You should always choose a primary key whose value will not change. In databases that use more than one table, the primary key in one table is often included in other tables as a reference. If the primary key changes, the change must also be applied everywhere the key is referenced. Using a primary key that will not change reduces the chance that the primary key might become out of sync with its references.

Often an arbitrary unique number is used as the primary key. For example, you might assign each order a unique order number. The order number's only purpose is to identify an order. Once assigned, it never changes.

Sometimes an incremental value gen-

erated by the DBMS can be used as the primary key (for instance, the counter type used in Microsoft Access). Such an identifier is factless; it contains no factual information describing the row that it represents. A primary key that contains facts about a row—a telephone number or a customer name, for example—is more likely to change because the factual information itself might change. Use factless identifiers whenever possible.

BOOK DATABASE PRIMARY KEYS

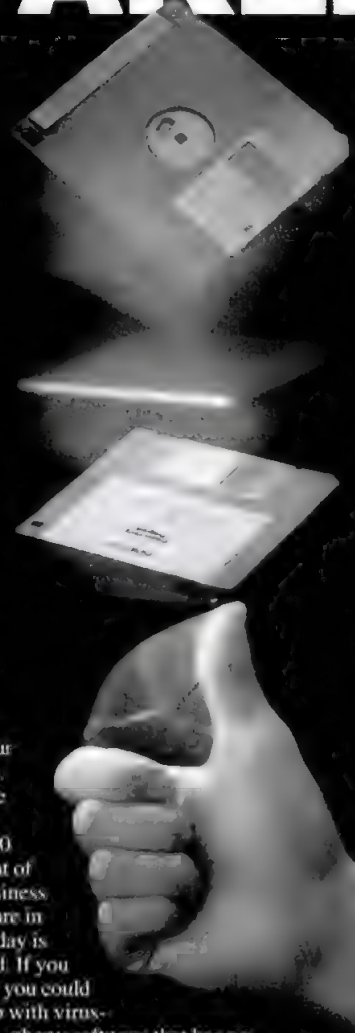
For the book database, we'll add an arbitrary unique number as the primary key to each of our three tables. For the book table, we'll call the primary key BookID. For the author table, we'll call it AuthID. And finally, for the publisher table, we'll call it PubID. Figure 2 shows the current design along with some sample information.

You might be wondering why I chose to include a BookID column in the book table in addition to the ISBN column. After all, ISBN is supposed to be unique, why not use it as the primary key? The reason is that the assignment of ISBNs is externally controlled. The advantage to creating your own ID is that you maintain control over the assignment of appropriate values. The disadvantage, of course, is that assigning appropriate values might require some work and some incremental disk space. Another popular external identifier is the Social Security number. While it's tempting to use this number as the primary key, Social Security numbers, like the ISBN, are problematic because they can change or be reassigned. It's usually better to maintain control yourself.

THE MAILBOX Send comments, questions, or suggestions to Dale Lewallen, Senior Editor (MCI: 338-5922 or CompuServe 72241,1773) or Sal Ricciardi, Contributing Editor (MCI: 347-7663 or CompuServe 72241,33). □

SAL RICCIARDI IS A CONTRIBUTING EDITOR OF PC MAGAZINE AND AUTHOR OF *RUNNING MICROSOFT FOXPRO FOR WINDOWS AND RUNNING MICROSOFT FOXPRO FOR MS-DOS*, FROM MICROSOFT PRESS.

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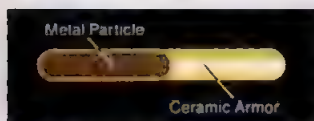
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BY RICHARD HALE SHAW

Track Record: A PIM for Developers

If you're a software developer whose system for tracking bugs and scheduling appointments is to scribble them on scraps of paper, then Track Record (\$159) is made for you. Track Record (from UnderWare, the creators of BRIEF) is like no other tool out there. If you take the time to learn Track Record's ins and outs, you'll be rewarded with a multiuser, nonprogrammable database designed to track all aspects of software development. But be prepared to spend a lot of time learning how to use it.

More than a personal information manager (PIM) or a project manager, Track Record is an object-oriented database that can track and record almost everything you need to manage during software development. In addition to providing a detailed audit trail, Track Record can display bug reports, list deadlines, and assign priorities in order to keep a software project moving.

OBJECT-ORIENTED DATABASE The Track Record database is object-oriented in that each data record is an item of a predefined type, and the types are hierarchically arranged. For example, developer, software user, and beta tester types are derived from the people type; classes, functions, and source-file types are derived from the program unit type. Since you can create or derive new types, object-oriented databases are unusually flexible; you can customize the database to fit your needs.

Track Record provides additional power through its ability to cross-reference, or link, various pieces of information. Some links are set up automatically. For example, bug reports are automatically linked to the person assigned

to fix the bug and to the person who reported it. To manually link one item to another, you right-click the mouse on one item and drag to the other—easy to do but nonobvious.

If you use Track Record as part of a workgroup on a network, you are informed by a traffic-light icon when you must wait for another user to complete a task. When a user changes the data, all users viewing the data will see the change within 2 minutes. Security features are extremely limited in this first release but will be enhanced in future upgrades.

MULTIPLE VIEWS Track Record lets you enter and display data in four views: Item, Outline, Calendar, and Query. The Item view is where you enter or edit data; it displays all the fields associated with an item. For instance, an Item View of a beta tester will include his address, phone number, and e-mail address, along with a link to company information. Fields from linked items can be viewed or edited by clicking on a little "expansion lever." Click again on the expansion lever and the linked fields disappear.

The Outline and Calendar views let you organize item-level data according to your needs. Both use the Query view to specify which items to display. Queries can be saved in the database and reused.

The Query view uses a unique variation on query-by-example, which, while not difficult, takes some getting used to. First you select the field to search by browsing through the hierarchy of types and drilling down. Then you use the mouse to drag and drop the field onto the

query-building area. Next you switch to the Query Tools dialog by clicking on an index-style tab, and use operator buttons (such as = or <) to build the query. Conditional expressions can be ORed or ANDed together for complex queries.

In the Outline view, each header is attached to a query, and the query results are displayed in a list below the header. So you could set up a header to display "today's bug reports" or "beta testers for this project." You can change which fields of the item are displayed by right-clicking the mouse on the item and selecting Set Columns. Maybe you'd prefer to list each beta tester's company rather than his address. By carefully choosing the headers and item fields, you can design reports for every conceivable aspect of your project—a weekly bug report, a list of the features implemented today, a prioritized list of critical tasks.

The Calendar lets you display information by date and time, and can be used to schedule tasks, set due dates, arrange meetings, and the like. You can maintain as many calendars as you want, and you can use the Query view to display only those time-sensitive items that are of current interest. For example, your calendar might show all deadlines for a project or just list the tasks assigned to a particular person. Unfortunately, there is no alarm clock feature, but it is planned for a future release.



Track Record comes with a detailed manual—a pamphlet entitled "How Do I...," a one-pager with quick-start information, and extensive sample Outline and Calendar views. Track Record takes some time to learn, but there's nothing else quite like it for managing a software project.

Suitable for single-person projects or small workgroups, Track Record provides a unique means to get organized.

• Track Record, Version 1.0

List price: \$159 (introductory price of \$99 through 12/31/93). Requires: 386-based machine or better, 2MB RAM (4MB suggested), 2MB disk space for program files. UnderWare Inc., 321 Columbus Ave., Boston, MA 02116; 617-267-9743.

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Environments

BY CHARLES PETZOLD

Working with Lines And Pens Under Windows NT

When I was very young, my mother (who was a math major for two of her college years) gave me my first lesson in geometry. "A straight line," she said, "is the shortest distance between two points." After thinking about it for awhile, I decided that she was correct. I guess I was naive.

Euclid couldn't do much better, of course. His definition of a straight line was one of the basic postulates of the ancient Greek geometers. If you didn't accept it, you just couldn't continue with geometry. The universe, unfortunately, refuses to be confined to an abstract euclidean space. Non-euclidean geometries are necessary to define it. For example, what is the shortest distance between two points on the surface of a sphere such as the earth? To travel in a euclidean straight line on the earth, you'd either have to dig or fly.

For many centuries, it was convenient to believe that the path of light defined a straight line. But then Einstein came along and showed that the path of light is affected by gravity. The implications are profound: We seem to be living in a universe that is finite, but which has no limits and from which we cannot escape—even if we follow a "straight line" out of it. Lines are definitely not as simple as they first may seem.

LINE ON THE SCREEN Computer screens and printer output are reasonably flat and not much affected by the

curvature of the earth or the principles of general relativity. We can easily pretend that computer graphics follow the postulates of Euclid and the analytical geometry of Descartes. Accordingly, the straight line is the most fundamental graphics primitive. (True, individual pixels are simpler than lines, but they're not very useful by themselves.) Still, even computer lines are not as simple as they first seem. In classical geometry, lines are abstractions without width, color, or style. In computer graphics, lines must be at least 1 pixel wide, but they can be wider; they can come in a variety of colors; and they can be composed of various sequences of dots and dashes.

These three characteristics of lines—width, color, and style—have been supported under the Windows Graphics Device Interface (GDI) since version 1.0 was released about eight years ago. The extensions to the Graphics Device Interface in Windows NT now allow additional approaches to drawing lines. Taking cues from PostScript and the OS/2 Graphics Programming Interface (GPI), Windows NT supports thick lines with selectable ends and joins, patterned lines, programmable line styles, and paths.

We'll begin to look at these extensions in the next installment of this column. In the meantime, let's thoroughly review how Windows 3.1 supports varying the appearance of lines. This support has, of course, been carried over into Windows NT with very few changes.

THAT THING CALLED THE PEN Many of the characteristics of lines you draw under GDI are governed by the Graphics Device Interface object called the *pen*. GDI objects are not the objects we've become familiar with under object-oriented programming, which consist of code and data bound together in a functional whole. GDI objects—pens, brushes, fonts, bitmaps, metafiles, and palettes—are merely chunks of dumb data stored in GDI memory. John Butler (the original designer of the Graphics Device Interface) told me that early GDI designs used attributes for each of the various characteristics of line appearance. Then designers realized they could bundle these attributes into a single entity, and the pen was born. Surely it seemed like a reasonable invention at the time.

As many programmers have come to realize, the concept of graphics objects is one of the major flaws of GDI and is a real nuisance to use. An object must be created, then selected into the device context, and later unselected from the device context

Let's thoroughly review how Windows 3.1 supports varying the appearance of lines. This support has been carried over into Windows NT with very few changes.

and deleted. Errant code that fails to delete the GDI objects that it has created can use up a large amount of GDI heap space. (Fortunately, this is less of a problem under Windows NT.) Most programmers would prefer setting attributes, which GDI also includes for some drawing properties (such as text color). Indeed, when designers of C++ class libraries turn to GDI, they usually make it a priority to hide the creation, selection, and deletion of GDI objects.

Under Windows 3.1 (and Windows NT), a programmer can create a logical pen by calling `CreatePen()` or `CreatePen-`

NTGDI.C

Complete Listing

```

/*-----
NTGDI.C -- NT GDI Demonstration Shell Program
(c) Charles Petzold, 1993
-----*/

#include <windows.h>
#include <string.h>
#include "ntgdi.h"

extern void PaintRoutine (HWND, HDC, int, int);
long FAR PASCAL WndProc (HWND, UINT, UINT, LONG);

HANDLE hInst;

extern char szClass [];
extern char szTitle [];

int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
                    LPSTR lpzCmdLine, int nCmdShow)
{
    char szResource [] = "NTGDI";
    HWND hwnd;
    MSG msg;
    WNDCLASS wndclass;

    hInst = hInstance;

    if (!hPrevInstance)
    {
        wndclass.style = CS_HREDRAW | CS_VREDRAW;
        wndclass.lpfnWndProc = WndProc;
        wndclass.cbClsExtra = 0;
        wndclass.cbWndExtra = 0;
        wndclass.hInstance = hInstance;
        wndclass.hIcon = LoadIcon (NULL, IDI_APPLICATION);
        wndclass.hCursor = LoadCursor (NULL, IDC_ARROW);
        wndclass.hbrBackground = GetStockObject (WHITE_BRUSH);
        wndclass.lpszMenuName = szResource;
        wndclass.lpszClassName = szClass;

        RegisterClass (&wndclass);
    }

    hwnd = CreateWindow (szClass, szTitle,
                        WS_OVERLAPPEDWINDOW,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        NULL, NULL, hInstance, NULL);

    ShowWindow (hwnd, nCmdShow);
    UpdateWindow (hwnd);

    while (GetMessage (&msg, NULL, 0, 0))
    {
        TranslateMessage (&msg);
        DispatchMessage (&msg);
    }

    return msg.wParam;
}

BOOL PrintRoutine (HWND hwnd)
{
    static char szMessage [80];
    static char szPrinter [80];
    BOOL bReturn = TRUE;
    char *szDevice, *szDriver, *szOutput;
    DOCINFO di;
    HDC hdcPrn;
    int cxPage, cyPage;

    GetProfileString ("windows", "device", ".,.,", szPrinter, 80);

    if ((szDevice = strtok (szPrinter, ",")) &&
        (szDriver = strtok (NULL, ",")) &&
        (szOutput = strtok (NULL, ",")))
    {
        hdcPrn = CreateDC (szDriver, szDevice, szOutput, NULL);

        if (hdcPrn == NULL)
            return FALSE;

        cxPage = GetDeviceCaps (hdcPrn, HORZRES);
        cyPage = GetDeviceCaps (hdcPrn, VERTRES);

        strcpy (szMessage, szClass);

        strcat (szMessage, ": Printing");

        di.cbSize = sizeof (DOCINFO);
        di.lpszDocName = szMessage;
        di.lpszOutput = NULL;

        if (StartDoc (hdcPrn, &di) > 0)
        {
            if (StartPage (hdcPrn) > 0)
            {
                PaintRoutine (hwnd, hdcPrn, cxPage, cyPage);

                if (EndPage (hdcPrn) <= 0)
                    bReturn = FALSE;
            }
            else
                bReturn = FALSE;

            if (EndDoc (hdcPrn) <= 0)
                bReturn = FALSE;
        }
        else
            bReturn = FALSE;

        DeleteDC (hdcPrn);

        return bReturn;
    }

    long FAR PASCAL WndProc (HWND hwnd, UINT message, UINT wParam, LONG lParam)
    {
        BOOL bReturn;
        static int cxClient, cyClient;
        HDC hdc;
        PAINTSTRUCT ps;

        switch (message)
        {
            case WM_COMMAND:
                switch (wParam)
                {
                    case IDM_PRINT:
                        SetCursor (LoadCursor (NULL, IDC_WAIT));
                        ShowCursor (TRUE);

                        bReturn = PrintRoutine (hwnd);

                        ShowCursor (FALSE);
                        SetCursor (LoadCursor (NULL, IDC_ARROW));

                        if (!bReturn)
                            MessageBox (hwnd,
                                "Error encountered during printing",
                                szClass, MB_ICONASTERISK | MB_OK);

                        return 0;

                    case IDM_EXIT:
                        SendMessage (hwnd, WM_CLOSE, 0, 0);
                        return 0;

                    case IDM_ABOUT:
                        MessageBox (hwnd, "NT GDI Demonstration Program\n"
                            "Copyright (c) Charles Petzold, 1993",
                            szClass, MB_ICONINFORMATION | MB_OK);

                        return 0;

                    default:
                        break;
                }

            case WM_SIZE:
                cxClient = LOWORD (lParam);
                cyClient = HIWORD (lParam);
                return 0;

            case WM_PAINT:
                hdc = BeginPaint (hwnd, &ps);

                PaintRoutine (hwnd, hdc, cxClient, cyClient);

                EndPaint (hwnd, &ps);
                return 0;

            case WM_DESTROY:
                PostQuitMessage (0);
                return 0;
        }

        return DefWindowProc (hwnd, message, wParam, lParam);
    }
}

```

Figure 1: NTGDI.C contains the shell source code for the Windows NT GDI demonstration programs.

Indirect(). (The pen is referred to as logical because this term describes desired pen characteristics that may or may not be realizable when the pen is selected into a particular device context.) The CreatePen() function describes the pen using three parameters; CreatePenIndirect() uses a LOGPEN structure with

three fields. The functions are basically equivalent. Both return a handle to the logical pen.

WINDOWS 3.1 PENS Under Windows 3.1, a pen has three characteristics—a style, a width, and a color. These characteristics are the three parameters to the CreatePen() function:

```
hPen = CreatePen (dwStyle,
                  dwWidth, dwColor);
```

These determine the appearance of the lines that you draw after the created pen has been selected into the device context. The first parameter is the pen style, which can be any one of the seven identifiers



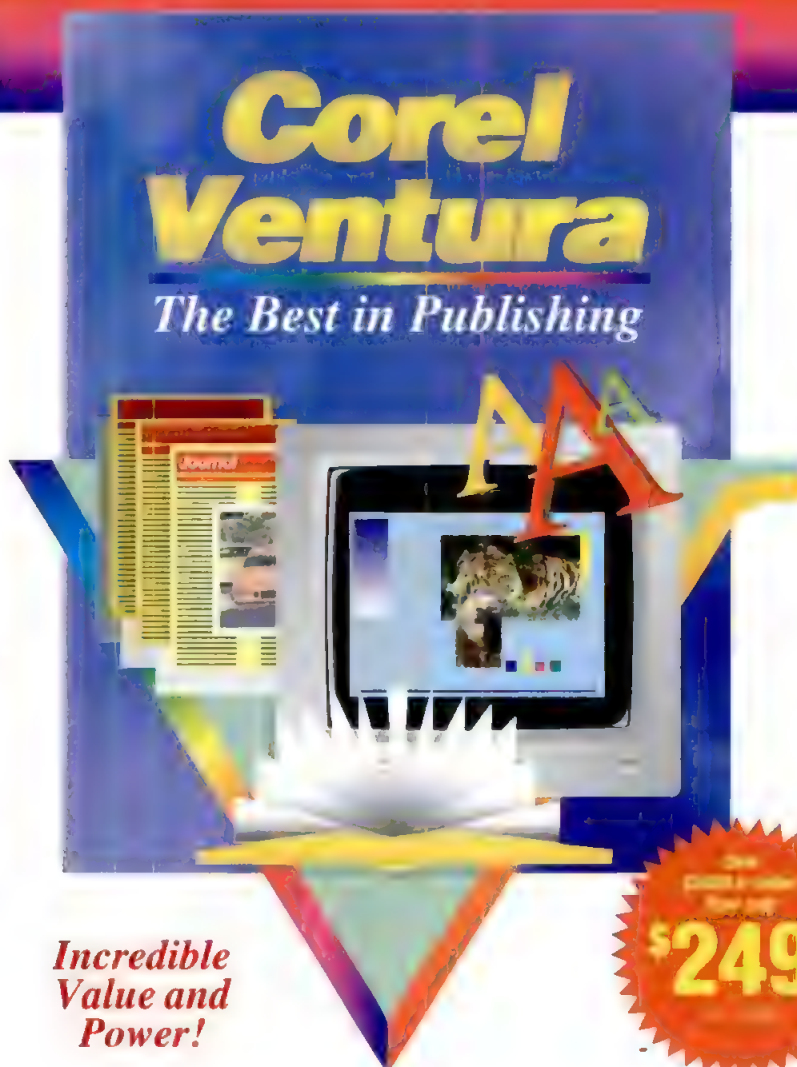
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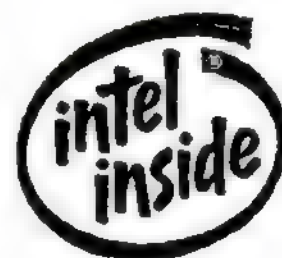
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LNWIDTH.MAK

Complete Listing

```
#-----
# LNWIDTH.MAK make file
#-----

!include <ntwin32.mak>

lnwidth.exe : lnwidth.obj ntgdi.obj ntgdi.rbj
    $(link) $(guiflags) -out:lnwidth.exe lnwidth.obj ntgdi.obj \
        ntgdi.rbj $(guilibs)

lnwidth.obj : lnwidth.c
    $(cc) $(cflags) $(cvars) lnwidth.c

ntgdi.obj : ntgdi.c ntgdi.h
    $(cc) $(cflags) $(cvars) ntgdi.c

ntgdi.rbj : ntgdi.rc ntgdi.h
    $(rc) $(rcvars) -r ntgdi.rc
    cvtres -$(CPU) ntgdi.res -o ntgdi.rbj
```



Figure 2: This make file facilitates compilation of the LNWIDTH program.

that begin with the prefix PS:

```
PS_SOLID
PS_DOT
PS_DASH
PS_DASHDOT
PS_DASHDOTDOT
PS_INSIDEFRAME
PS_NULL
```

The PS_SOLID style creates a pen that draws solid lines. Five other styles create pens composed of sequences of dots and dashes. The length and spacing of these dots and dashes are determined by the device driver to give a reasonable appearance on the particular device. These lengths and spacings are not affected by any mapping mode or transform in effect. The PS_NULL style creates a pen that doesn't draw anything. I'll discuss the PS_INSIDEFRAME style separately. The descriptions that follow apply to the other styles.

The second parameter to CreatePen() is the pen width in logical units. Logical units are not necessarily pixels. You could set a mapping mode to draw in units of millimeters or inches. Or you could have a transform in effect. These both affect the pen width. For example, if you use the MM_LOENGLISH mapping mode (which means that logical units are 0.01 inches), and you specify the pen width as 25, then your lines will be a quarter of an inch wide. The width of a thick pen straddles each side of the the-

oretical line that you draw. Lines drawn with thick pens are rounded at the ends. Specifying 0 for the second parameter gives you a pen that is a single pixel wide, regardless of the mapping mode or any transform that may be in effect.

There's a catch, though: The various dotted and dashed styles are guaranteed *only* if the pen width is set to 0. Some drivers may be capable of drawing dotted and dashed lines with nonzero pen widths, but the current VGA driver can not. If you specify a nonzero pen width

and one of the dotted or dashed styles, you'll get a solid line instead.

What GDI draws between the dots and dashes is determined by the SetBkMode() function. A parameter of TRANSPARENT tells GDI to leave unchanged the existing background color that happens to be between the dots and dashes. A parameter of OPAQUE instructs GDI to fill in the spaces with the current background color, set using the SetBkColor() function.

The third parameter to CreatePen() is the pen color, specified as an RGB (red-green-blue) color value. This color (as well as the background color if you're using a background mode of OPAQUE and drawing dotted and dashed lines) is converted to the nearest pure color available on the output device.

The PS_INSIDEFRAME style is similar to the PS_SOLID style with two exceptions. First, when you use one of the drawing functions that involve a bounding rectangle (such as Rectangle and Ellipse), a thick line will straddle the theoretical line. For PS_INSIDEFRAME, however, the entire width of the line is inside the figure. Suppose you have a child window that is 100 units wide and 100 units high. If you draw a rectangle between the points (0,0) and (100,100) with a PS_INSIDEFRAME pen, the full

LNWIDTH.C

Complete Listing

```
/*-----
LNWIDTH.C -- CreatePen Line Widths
(c) Charles Petzold, 1993
-----*/

#include <windows.h>

char szClass [] = "LnWidth" ;
char szTitle [] = "LnWidth: CreatePen Line Widths" ;

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    int y, iWidth ;

    for (y = 20, iWidth = 0 ; iWidth <= 20 ; y += 20, iWidth++)
    {
        SelectObject (hdc,
            CreatePen (PS_SOLID, iWidth, RGB (0, 0, 0))) ;

        MoveToEx (hdc, 20, y, NULL) ;
        LineTo (hdc, cxArea - 20, y) ;

        DeleteObject (
            SelectObject (hdc,
                GetStockObject (BLACK_PEN))) ;
    }
}
```



Figure 3: The LNWIDTH program demonstrates different line widths.

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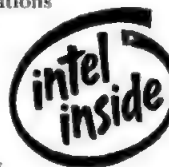
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Figure 4: The LNWIDTH program displays 21 lines ranging from a width of 0 to a width of 20.

width of the rectangular outline will be within the child window. A PS_SOLID pen would have half the pen width outside the boundaries of the child window.

Second, PS_INSIDEFRAME differs in that dithered colors are used for pen widths of 2 pixels or more. As opposed to the other styles, the specified color is not converted to the closest pure color available on the device.

TAKING A LOOK AT PENS In the next few issues, we'll be looking at a number of sample programs that illustrate line-drawing techniques. Rather than reproduce all of the Windows NT program overhead in each program, I've written a shell program that contains this overhead, which includes printing the graphics output on the default printer. The source code for the shell program is shown in Figure 1.

NTGDI.C is missing some pieces, preventing it from being a complete program: a window class name (szClass), a window title (szTitle), and, most importantly, a drawing function called PaintRoutine(). NTGDI.C calls PaintRoutine() during the WM_PAINT message, passing to the function the window handle, device context handle, and the width and height of the client area (obtained during the WM_SIZE message). We'll be looking at numerous PaintRoutine() functions over the next few issues.

NTGDI.C also processes a menu command to print. For this job, NTGDI.C calls the PrintRoutine function() (located in NTGDI.C), which has the same code you'd use for simple printing in a Windows 3.1 program. The function creates

a device context for the default printer, and then obtains the width and height of the printable area of the printer page. The function calls StartDoc, StartPage, then PaintRoutine(), followed by EndPage and EndDoc. (In a more sophisticated Windows NT program, you'd want to use a separate thread for this job.)

Thus, the numerous PaintRoutine() functions we'll be creating can be used for displaying graphics both in the client area and on a single page of paper from the printer.

LOOKING AT LINE WIDTHS To get the hang of this—and to assure ourselves that we know the ins and outs of creating Windows 3.1-compatible pens under Windows NT—let's write a couple of PaintRoutine() functions. I won't bore you with one that displays all the pen styles or a bunch of colors; I'm sure you've seen these too many times before. But let's look at some pen widths.

Figures 2 and 3 show LNWIDTH.MAK (a make file) and LNWIDTH.C, which contains a PaintRoutine() function. The make file contains command lines to compile both LNWIDTH.C and NTGDI.C, and links them together with the compiled resource script. If you have Windows NT and the Win32 SDK installed, you can create LNWIDTH.EXE by running

```
NMAKE LNWIDTH.MAK
```

on a Windows NT command line. Or you can download all the source code and the executable from PC MagNet's Programming forum archived as LN.ZIP.

LNWIDTH draws 21 horizontal lines beginning with a width of 0 at the top and increasing to a width of 20 at the bottom. The lines are spaced 20 pixels apart, and they begin and end 20 pixels from the edges of the client area. You can view these lines on your screen, as shown in Figure 4, or send them to your printer.

Note that the first and second lines are the same width—1 pixel. Also, notice how the last two lines bump into each other. This demonstrates that the wide line straddles the geometrically theoretical line. In addition you can see that the ends of the wider lines are rounded. The rounded part goes beyond the point where the line begins and ends, making these lines appear closer to the edges of the window.

You can try substituting dotted and dashed line styles in this program. For all widths except 0 and 1, you'll get solid lines. (I mentioned above that styled lines are guaranteed only for widths of 0. With the default mapping mode, you'll get styled lines for widths of 1, but usually not with other mapping modes.)

THE INSIDE-FRAME STYLE The PS_INSIDEFRAME style can be confusing on first encounter, but let's demystify it by writing a program that clearly illustrates the difference between this style and PS_SOLID. The program, shown in Figures 5 and 6, is called LNFRAME.

LNFRAME.MAK

Complete Listing

```
#-----
# LNFRAME.MAK make file
#-----

!include <ntwin32.mak>

lnframe.exe : lnframe.obj ntgdi.obj ntgdi.rbj
$(link) $(guiflags) -out:lnframe.exe lnframe.obj ntgdi.obj \
    ntgdi.rbj $(guilibs)

lnframe.obj : lnframe.c
$(cc) $(cflags) $(cvars) lnframe.c

ntgdi.obj : ntgdi.c ntgdi.h
$(cc) $(cflags) $(cvars) ntgdi.c

ntgdi.rbj : ntgdi.rc ntgdi.h
$(rc) $(rcvars) -r ntgdi.rc
cvtres -$(CPU) ntgdi.res -o ntgdi.rbj
```

Figure 5: This make file facilitates compilation of the LNFRAME program.



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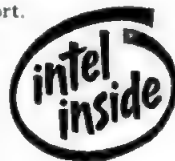
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For ease in drawing in the client area (and on the printer page), the PaintRoutine function in LNFRAME.C sets an anisotropic mapping mode where both the width and height of the client area are 100 units in length. The program then creates a 10-pixel wide pen using PS_SOLID and draws a rectangle and ellipse at the top of the client area. A 10-pixel wide PS_INSIDEFRAME pen is used to draw the same figures at the bottom of the client area. (In each case, the pen color is the RGB value C0-40-C0, which is not one of the standard VGA colors.) Then, a black 1-pixel wide pen draws four rectangles—the bounding boxes—using the same coordinates.

The results (Figure 7) illustrate the differences: The PS_SOLID rectangle straddles the bounding box; the PS_INSIDEFRAME figures are within the bounding box. The PS_SOLID figures are displayed in pure colors (magenta), while the PS_INSIDEFRAME colors are dithered.

LINE WIDTHS As we've seen, NT is compatible with Windows 3.1 in using the CreatePen() function. But there's at least one implementation difference, which is important to take note of. When I began working on sample wide-line code for these columns, something didn't look right—rather, I saw something I had never seen under Windows 3.1. For a demonstration, resize LNFRAME so it's either a tall, narrow window or a short, wide one. The left and right sides of the rectangle and ellipse will have different widths than the top and bottom sides. For the ellipse, the width of the line changes as it orbits around the figure! You won't see this under Windows 3.1. (You can simulate the effect, but you'd need to use regions.) Let's figure out what's going on.

LNFRAME uses an anisotropic mapping mode. It sets the height and width of the client area to be 100 units, regard-

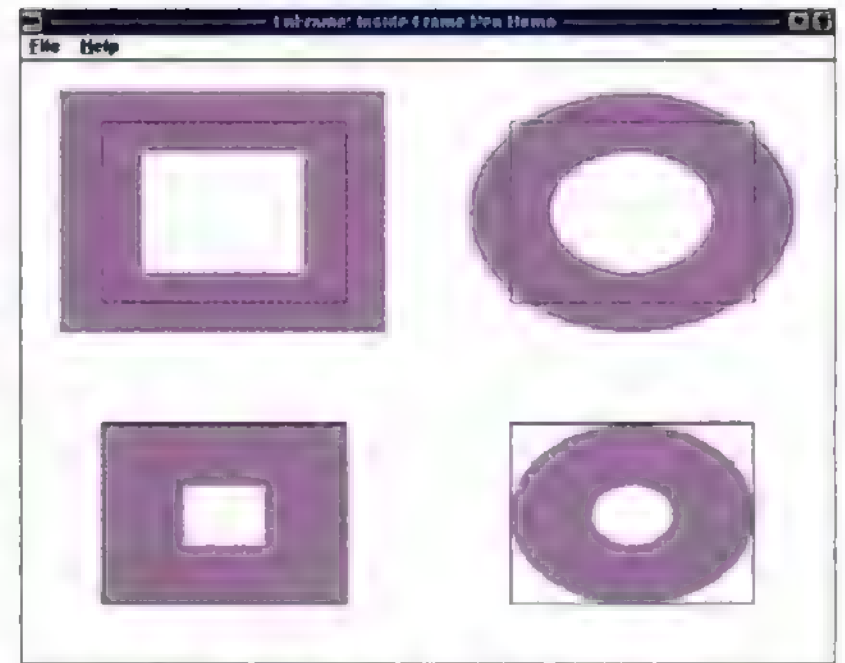


Figure 7: The LNFRAME display shows the differences between the PS_SOLID and PS_INSIDEFRAME styles.

less of the pixel dimensions. The pen width is 10 units. So if the client area is not square, 10 units on the horizontal axis will not equal 10 units on the vertical axis. Windows NT takes this difference into account when drawing the lines. Windows 3.1 does not. Instead, Windows 3.1 uses the horizontal dimension to compute a pen width in pixels and uses that width uniformly.

Which brings us to CreatePenIndirect(), a function traditionally ignored because it provides no additional functionality over CreatePen(). CreatePenIndirect() takes a single parameter, a pointer to a LOGPEN structure:

```
typedef struct tagLOGPEN
{
    UINT    lopnStyle ;
    POINT    lopnWidth ;
    COLORREF lopnColor ;
}
LOGPEN ;
```

Note that the second field is a POINT structure, suggesting the possibility of specifying different horizontal and vertical line widths. In the past, only the x field of the POINT structure was used; the y field was ignored. Might this feature have finally been enabled under Windows NT? The answer, unfortunately, is no. Windows NT still ignores the y field of the POINT structure and thus, CreatePenIndirect() provides only equivalent functionality to CreatePen().

In the next issue, we'll begin examining ExtCreatePen(), the new extended pen-creation function in Windows NT. □

LNFRAME.C

Complete Listing

```
/*-----
LNFRAME.C -- Inside-Frame Pen Demo
(c) Charles Petzold, 1993
-----*/

#include <windows.h>

char szClass [] = "LnFrame" ;
char szTitle [] = "LnFrame: Inside-Frame Pen Demo" ;

void PaintRoutine (HWND hwnd, HDC hdc, int cxArea, int cyArea)
{
    SetMapMode (hdc, MM_ANISOTROPIC) ;
    SetWindowExtEx (hdc, 100, 100, NULL) ;
    SetViewportExtEx (hdc, cxArea, cyArea, NULL) ;

    SelectObject (hdc, GetStockObject (NULL_BRUSH)) ;

    // Solid Wide Pen

    SelectObject (hdc,
        CreatePen (PS_SOLID, 10, RGB (196, 64, 196))) ;

    Rectangle (hdc, 10, 10, 40, 40) ;
    Ellipse (hdc, 60, 10, 90, 40) ;

    // Inside-Frame Wide Pen

    DeleteObject (
        SelectObject (hdc,
            CreatePen (PS_INSIDEFRAME, 10, RGB (196, 64, 196)))) ;

    Rectangle (hdc, 10, 60, 40, 90) ;
    Ellipse (hdc, 60, 60, 90, 90) ;

    // Stock Pen

    DeleteObject (
        SelectObject (hdc,
            GetStockObject (BLACK_PEN))) ;

    Rectangle (hdc, 10, 10, 40, 40) ;
    Rectangle (hdc, 60, 10, 90, 40) ;

    Rectangle (hdc, 10, 60, 40, 90) ;
    Rectangle (hdc, 60, 60, 90, 90) ;
}
```

Figure 8: LNFRAME.C demonstrates the difference between PS_SOLID and PS_INSIDEFRAME.



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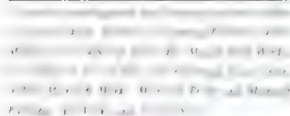
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Power Programming

BY KAARE CHRISTIAN

The C++ Iostream Library

I'm sure you are familiar with "Hello, World," C style:

```
#include <stdio.h>
void main()
{
    printf("Hello, world.\n");
}
```

But how many of you can write "Hello, world" in C++ style?

```
#include <iostream.h>
void main()
{
    cout << "Hello, world." << endl;
}
```

The difference is that the C++ version uses the iostream library in order to output the greeting.

Iostreams, which were created by Jerry Schwarz at AT&T, are a C++ alternative to the venerable C standard I/O (stdio) library. Like stdio, iostreams are text-oriented when used for screen I/O. Though outmoded in today's world of graphical user interfaces, there is still a strong need for stream I/O to read and write data in files.

Iostreams were designed to support the object-oriented paradigm. The iostream library was the first class library to achieve widespread use, and today it is the only class library that is delivered with every C++ compiler. The iostream library also offers a valuable lesson in object-oriented design, because it uses both single and multiple inheritance and makes good use of operator functions.

The basic idea behind iostreams' object-oriented approach is that objects themselves know how to read and write.

This makes iostreams completely type-safe. If you use an unsigned long variable for input, then the iostream library's routine for input to unsigned longs will be used automatically. Unlike the stdio library, there's no way in the iostream library to get a mismatch between data types and the actual input conversion operations.

The stdio library uses C's powerful feature of allowing a variable number of arguments. But this feature's flexibility comes at a price. There's no compiler-checking to ensure that a printf() statement's format string agrees with its argument list.

The iostream library takes a different approach. Input and output are accomplished via expressions, with overloaded operator functions for each data type. If you need to read or write a new data type, you can extend iostreams with your own overloaded operator functions.



Figure 1: The iostream library is based on the ios class. The two descendants of ios are istream and ostream, which are specialized for input and output, respectively.

You may find this new approach awkward at first—the iostream library is somewhat bigger and slower than stdio—but this is a small price to pay for a reliable, extensible, object-oriented I/O facility. Still, if iostream doesn't suit your taste, you can continue to use the stdio library in C++ programs, because C++ is downwardly compatible with C.

THE IOSTREAM CLASS HIERARCHY The iostream library is based on the ios class, which contains the functionality that's common to both input and output. The class hierarchy is shown in Figure 1. The two descendants of ios are istream and ostream, which are specialized for input and output, respectively. The major role of istream and ostream is to contain the extraction and insertion operator functions. Further specialization is attained by deriving string and file stream classes from istream and ostream. The string classes are analogous to sprintf() and sscanf(); the file iostream classes are analogous to fprintf() and fscanf().

In addition, there is a hybrid class, called iostream, that can be used for both input and output. The iostream class is multiply derived from both istream and ostream, and it too serves as a base class for string and file classes.

Not shown in Figure 1 is the streambuf class, which is the worker-bee class that manages data storage for the iostream library. You'll only need to know about the streambuf class if you derive a new class from one of the existing iostream classes, which is rarely necessary.

The first part of this article covers the basics of using iostreams, which means learning how to read and write (*extract* and *insert* in iostream jargon) the built-in data types. Then we'll move to a more advanced topic, writing your own insertion and extraction operators so you can use iostreams on your own data types. As an example, we'll read and write some of the short data structures used by Windows' Common Dialog library.

SIMPLE INSERTION Let's start with a simple C standard I/O program, and then recast that program using C++ iostreams. Here's the C program:

```
#include <stdio.h>
void main()
{
```



```
char *msg = "Hello, world";
printf("%d. %s%c\n", 1, msg, '!');
}
```

As you can see, this is a simple-minded variant of "Hello, world" that prints the following message:

```
1. Hello, world!
```

The `printf()` format string in this example includes three format codes: `%d`, `%s`, and `%c`, which instruct `printf()` to output an integer, a string, and a single character, respectively. As the programming world knows by now, this is a very fragile system. If you forget to include an argument, as in the following, then nonsense output results:

```
printf("%d. %s%c\n", msg, '!');
```

Of course, the error is easy for an expert to spot. But do you remember how long you agonized when trying to find the problem the first time you made a similar `printf()` error?

Here's the `iostream` version of this "Hello, world":

```
#include <iostream.h>
void main()
{
    char *msg = "Hello, world";
    cout << 1 << ". " << msg
        << '!' << endl;
}
```

This produces exactly the same output as the C standard I/O version, but otherwise everything is different. The output in the `iostream` program is produced by an expression, rather than a call to a single, `printf()`-like subroutine. This expression is called an *insertion expression*, because text is inserted into the output stream.

Let's take a detailed look at how the `iostream` version works. The first step toward understanding insertion is to parenthesize the expression, so we see how it is analyzed by the compiler:

```
((((cout << 1) << ". ") << msg)
 << '!') << endl;
```

The `cout` object is analogous to the C library's `stdout` connection. It is a prebuilt `ostream` object that is used for output and corresponds to `stdio`'s `stdout`. (The other prebuilt `iostream` objects are `cin` for input, `cerr` for error output, and `clog` for logging. The `cin` and `cerr` objects correspond with `stdio`'s `stdin` and `stderr` connections, and `clog` is a buffered form of `cerr`. The `c` prefix stands for console.) When the compiler encounters the above `iostream` expression, it starts with the innermost layer and works its way out. The innermost layer is simply

```
cout << 1
```

When the compiler parses this expression, it looks for an `operator<<()` function whose left operand is an `ostream` ob-

ject and whose right operand is an `int`. The compiler finds the declaration of the overloaded `operator<<()` function in the `iostream.h` header file. The C++ compiler transforms the original insertion expression into a somewhat more manageable insertion expression:

```
((operator<<(cout, 1) << ". ")
 << msg) << '!' << endl;
```

This may not look like progress to you or me, but it's progress to the compiler. When the function `operator<< (ostream&, int)` is executed, it outputs the integer argument and returns the `cout` object (its first argument). The number 1 is printed, and the innermost part of the resulting expression is now

```
cout << ". "
```

Now the compiler looks for an `operator<<()` function whose left operand is an `ostream` and whose right operand is a string (technically, a `char*`). (There are operator functions for all of the built-in data types.) This process continues until the `iostream` insertion expression has been reduced to a set of `operator<<()` function calls (see Figure 2).

As I've already mentioned, `iostreams` are type-safe, since each data type is handled by its own overloaded extraction or insertion function. Let's see how an `iostream` program behaves when we make a mistake like the one made earlier with the C standard I/O library. In the earlier example, we forgot the first argument to `printf()`. Here's that same mistake, recast using `iostreams`:

```
cout << ". " << msg << '!' << endl;
```

The resulting output is easily predictable:

```
. Hello, world!
```

That's certainly not the desired output message, but it's sensible. This is a huge win: Most of the message gets across, even when there's an error. `iostream`'s sensible behavior is an even bigger win during input operations, because it avoids the crashes and other mysterious problems that result from the improper use of `scanf()`.

The original expression:

```
cout << 1 << ". " << msg << '!' << endl;
```

Parenthesize:

```
((((cout << 1) << ". ") << msg) << '!' << endl;
```

Transform to an equivalent function-call form:

```
operator<<(operator<<(operator<<(operator<<(operator<<(cout, 1), ". "), msg), '!'), endl;
```

Generate sequential code:

Function	Left Op	Right Op	Return
<code>operator<<(ostream&, int);</code>	<code>cout</code>	<code>1</code>	<code>cout</code>
<code>operator<<(ostream&, char *);</code>	<code>cout</code>	<code>". "</code>	<code>cout</code>
<code>operator<<(ostream&, char *);</code>	<code>cout</code>	<code>msg</code>	<code>cout</code>
<code>operator<<(ostream&, char);</code>	<code>cout</code>	<code>'!'</code>	<code>cout</code>
<code>operator<<(ostream&, ostream& (*f) (ostream&));</code>	<code>cout</code>	<code>endl</code>	<code>cout</code>

During execution, generate output:

```
1. Hello, world!
```

Figure 2: When the compiler reads an `iostream` insertion expression, each overloaded `<<` operator is replaced with the appropriate `operator<<()` function call.

C++ I/O Streams Complete Listing

```
#include <iostream.h>
void main()
{
    char firstInitial = '?';
    char lastName[40] = "cplusplus";
    int age = -1;
    cout << "Enter Last Name, First Initial, and Age" << endl;
    cin >> lastName >> firstInitial >> age;
    cout << "Name: " << firstInitial << ". " << lastName << endl;
    cout << "Age: " << age << endl;
}
```

Figure 3: The cin stream corresponds to stdin, by which data is read in. The cout stream corresponds to stdout, by which data is written out.

EXTRACTION OPERATORS Extraction is C++'s fancy term for input from a stream. Like insertion, extraction is performed by overloaded operator functions that are called by the compiler and based on the types of the data that you supply. Figure 3 shows a simple example that inputs a few values.

The extraction line of this program is the one that uses cin, the iostream library's prebuilt input object.

```
cin >> lastName >> firstInitial
>> age;
```

When the compiler encounters this extraction expression, it starts from the left and works its way across—just as with insertion expressions—calling the appropriate operator function depending on the data type.

So let's see what happens with erroneous input. Of course, bad data is bad data; the language can't help you there. But it can help keep your application up and running even in the face of bad data. Remember, the program is expecting a string, a single character, and a number, such as:

```
Smith S 30
```

If the input is

```
35 Smith
```

then the program will interpret 35 as the string (the last name) and S as the single character, and it will be stymied trying to interpret "mith" as a number. Because the input operations occur step-by-step, iostreams make checking for problems

after each input easy—a real boon for programmers. Scanf() also lets you read input piece by piece, but it doesn't let you check the data types, and it's not cleanly extensible to your own types.

Another frequent source of errors with the C standard I/O library is erroneous coding. Consider the following:

```
scanf("%s %c %d", lastName,
    firstInitial, age);
```

C mavens will immediately see the problem—you must pass the addresses of firstInitial and age. Unfortunately, the compiler will not complain.

A much more subtle scanf() error is the following:

```
double d;
scanf("%g", &d);
```

C mavens? Anyone? The problem here is that d is a double; you must either use %lg as the conversion specifier or change d to float. Blunders such as these simply aren't possible when you use the iostream library, because type checking is an integral part of the I/O process. The compiler ensures that the appropriate extraction operator function will be called for whatever type you use in an extraction expression.

IOSTREAM MEMBER FUNCTIONS Paranoia is a useful attitude for anyone who develops software, and that goes doubly for coding input operations. The preceding extraction example is robust in the sense that it doesn't crash when presented with nonsense input, but it certainly doesn't handle failure very gracefully. (The program in Figure 3 can crash if it's presented with a string longer than 40 characters. I'll address this problem shortly.)

All good programs check for erroneous input whenever they read in data. The way you do this with iostreams is to use the status-reporting member functions of the ios class and those of its two immediate offspring: istream and ostream. There are about 25 status and control member functions in these three classes, so I can't cover all of them here. Consult the iostream documentation of your compiler for full details. A brief summary of the most important status and control iostream functions is shown in Figure 4.

The program in Figure 5 shows a conservative approach to handling input. The stream's status is analyzed after each input operation, and the entire input operation is enclosed by a do loop that will accept erroneous input. You would need a different structure when reading from a file, because you can't ask a file to try again. Here is the repeat condition for the do loop

```
cin.fail() && !cin.bad()
```

The fail() member function returns true

Some Status and Control Functions

Function Name	Action
operator void*()	Returns 0 if the stream has an error condition.
int operator!()	Returns true if the stream has an error condition.
int good()	Returns true if the stream is okay.
int eof()	Returns true when the stream is an end of file.
int fail()	Returns true if a recoverable error, usually a conversion failure, has occurred.
int bad()	Returns true if a nonrecoverable error, usually an I/O failure, has occurred.
void clear()	Clears the stream's error state.
char fill(char c)	Sets the current fill character.
int precision(int n)	Sets the floating-point output precision.
int width(int n)	Sets the current I/O width.

Figure 4: Here is a brief summary of the most important status and control iostream functions.

One

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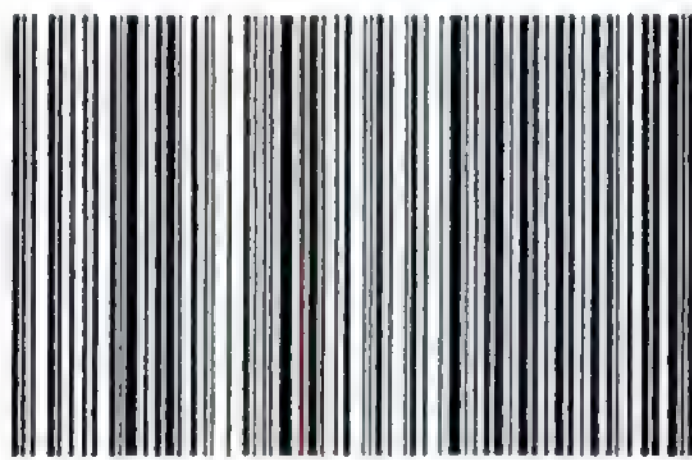
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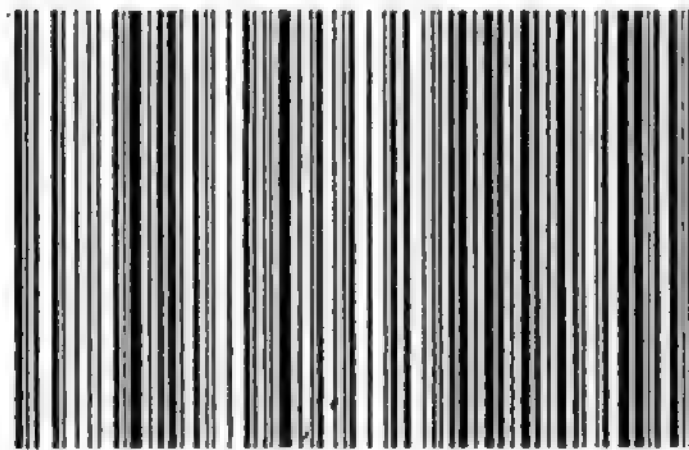
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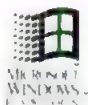
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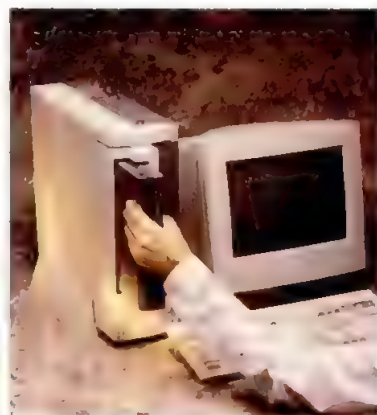


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Parameterized manipulators are quite a bit harder to write, because it's neces-

Iostream Manipulators

Manipulator	Istream	Ostream	Description
dec	■	■	Set the conversion base to decimal, octal, or hexadecimal.
oct	■	■	
hex	■	■	
ws	■	□	Skip whitespace.
ends	□	■	Ends outputs a null to a string stream; endl outputs an end of line character sequence; flush flushes a stream's buffer.
endl	□	■	
flush	□	■	
setfill(int ch)	■	■	Set the fill character to ch.
setprecision(int n)	■	■	The floating-point precision, which is the number of digits to the right of the decimal point.
setw(int w)	■	■	Set the field width for the next conversion. On input, it's the buffer width; on output it's the minimum output width.
setbase(int b)	■	■	Set the numeric conversion base.
setiosflags(int f)	■	■	Set or reset individual flags.
resetiosflags(long f)	■	■	

Figure 6: Iostream manipulators let you specify formatting for an input or output stream.

sary to build a class that will store both a pointer to the manipulator function and a pointer to the arguments for the manipulator function. Macros that simplify the process are present in the file `iomanip.h`, which also contains the definitions of the supplied parameterized manipulators. You can find more information on building parameterized manipulators in several different places, including Schwarz's paper on iostreams and many C++ texts.

FILE AND STRING IOSTREAMS One of the nicest things about the iostream library is that it works the same with any source of input or output: the keyboard and screen (the standard console connections), files, or strings (memory buffers). The main thing that you need to do to use a string or file with the iostream library is to create an iostream object of the appropriate type.

String streams correspond to the `stdio` functions `sprintf()` and `scanf()`. If you use string streams in a program, you must include the file `strstream.h`. There are three types of string streams: `istrstream` for input, `ostrstream` for output, and `strstream` for both input and output.

For output string streams, the two approaches are to either use your own buffer or to let the stream create one dynamically.

```
char mybuf[128];
ostrstream myStrm1(mybuf,
    sizeof(mybuf));
ostrstream myStrm2();
```

The `myStrm1` object uses `mybuf` as the buffer; `myStrm2` takes care of buffering for you by allocating memory dynami-

cally. However, `myStrm2` doesn't return a pointer to the allocated memory buffer. To access the buffer you must use the `str()` function, which freezes the dynamically allocated buffer and returns a pointer to it. Once frozen, the buffer can no longer function as an output stream, and you are responsible for deleting it and freeing the memory.

For input string streams, you can supply a string buffer that's null terminated, or you can specify its size explicitly, as shown here:

```
char *msg1 = "1 2.0 Three";
char msg2[50] = "4 5.0 Six";
istrstream s1(msg1);
istrstream s2(msg2, sizeof(msg2));
```

File streams let you read and write files, and correspond to `stdio`'s `fprintf()` and `fscanf()` statements. To use file iostreams in your programs, you must include the header file `fstream.h`. There are three types: `ifstream` for input, `ofstream` for output, and `fstream`, which supports both input and output. Creating a file stream without specifying a particular file and then using the `open()` member to attach the stream to a file is good programming practice. In the event that file `open` fails, this gives you more control than

CDLGRDWR.H

Complete Listing

```
typedef DWORD COLORS16[16];
ostream& operator<<(ostream& s, const LOGFONT& lf);
istream& operator>>(istream& s, LOGFONT& lf);
ostream& operator<<(ostream& s, const COLORS16 c);
istream& operator>>(istream& s, COLORS16 c);
```

Figure 7: The `cdlgrdwr.h` file contains function prototypes for `LOGFONT` and `COLORS16` insertion and extraction operators.

Insertion and Extraction Operator Functions

Complete Listing

```
ostream& operator<<(ostream& s, const COLORS16 c)
{
    s << hex;
    for(int i = 0; i < 16; i++)
        s << c[i] << endl;
    return s;
}
istream& operator>>(istream& s, COLORS16 c)
{
    s >> hex;
    for(int i = 0; i < 16; i++)
        s >> c[i];
    return s;
}
```

Figure 8: The `COLORS16` insertion and extraction operator functions are defined here.

you'd have if you tried to open the file within the constructor.

```
ifstream iFile;
iFile.open("c:\\tmp\\myapp.tmp");
```

After opening, you should check that the open succeeded:

```
if (!iFile.is_open()) {
    // handle file open error
}
```

And after you've finished using the stream, you should close the file by calling the close() member function.

INSERTION AND EXTRACTION OPERATORS

We've not yet discussed extending the library to work with your own data types, which is one of the most important features of the iostream library. For example, if you often use Windows's LOGFONT structures, you can create insertion or extraction operator functions that allow you to write the following:

```
LOGFONT oLogFont;
ifstream fin;
fin.open("times.lf");
fin >> oLogFont;
fin.close();
```

With iostreams, your additions truly extend the library and can be used in any way that the built-in insertion and extraction operators are used. Also, any home-built insertion or extraction operator functions work with all three types of streams (console, string, file), without any extra effort on your part.

The basic idea is very simple. All you need to do is write a function with one of the following signatures:

```
ostream& operator<<(ostream& sout,
    const mytype& x);
istream& operator>>(istream& sin,
    mytype& x);
```

Each of these operator functions takes two parameters. The first is a reference to a stream object, and the second is the value that you want to insert or the variable into which you are going to extract. In the body of the operator function, you do whatever it takes to perform the I/O. If you're writing an inserter or extractor

for something that's essentially a value, like a date or a time, then you should use low-level stream operations that read or write a byte at a time and model your code on one of the existing operator functions. If you're outputting an aggregate data type such as a structure, class, or array, then you should call the existing operators for their individual fields. And of course the return statement of the operator function must return the stream argument.

To show you how you can extend the iostream library, I created insertion and extraction operators that read and write some of the data structures used by Windows' Common Dialog boxes. The

Common Dialog boxes are easy to use, once you get the initialization right. For example, to use the Choose Color dialog, you must supply a pallet of 16 colors. In some cases you may want to specify these colors explicitly, perhaps using a hard-coded array of color values. But in other cases, you might want to store the selections in a file so that when a user restarts an application, the previous choices will be remembered.

Figure 7 shows the cdlgrdwr.h header file, which specifies the prototypes for the insertion and extraction functions for reading and writing arrays of 16 color values. Figure 8 shows the full source code for these two operator functions. Because COLORS16 is a data structure, I used the existing insertion and extraction operators.

To exercise these insertion and extraction operators, I created a simple Windows application that uses four of the Common dialogs: the Choose Color dialog, the Choose Font dialog, the File

Restoring the Saved Colors

Partial Listing

```
static CHOOSECOLOR chsclr;
static COLORS16 dwCustClr;
BOOL fSetColor = FALSE;

// chsclr initialization
chsclr.lStructSize = sizeof(CHOOSECOLOR);
chsclr.hwndOwner = m_hWnd;
chsclr.hInstance = NULL;
chsclr.rgbResult = 0L;
chsclr.lpCustColors = (LPDWORD) dwCustClr;
chsclr.Flags = CC_FULLOPEN;
chsclr.lCustData = 0L;
chsclr.lpfnHook = NULL;
chsclr.lpTemplateName = (LPSTR) NULL;

// fetch saved colors
ifstream sin;
sin.open("colors.val");
if (sin.is_open()) {
    sin >> hex >> chsclr.rgbResult >> dwCustClr;
    sin.close();
}

// run ChooseColor dialog
if (fSetColor = ChooseColor(&chsclr)) {
    // save chosen colors
    ofstream sout;
    sout.open("colors.val");
    if (sout.is_open()) {
        sout << hex << chsclr.rgbResult << endl
            << dwCustClr;
        sout.close();
    }
}
```

Figure 9: The COLORS16 insertion and extraction operators are used in this code listing to restore previously saved colors and write out new color selections.

Open dialog, and File Save As dialog. (Consult the Windows programmer's references for a full explanation of the Common Dialog library.)

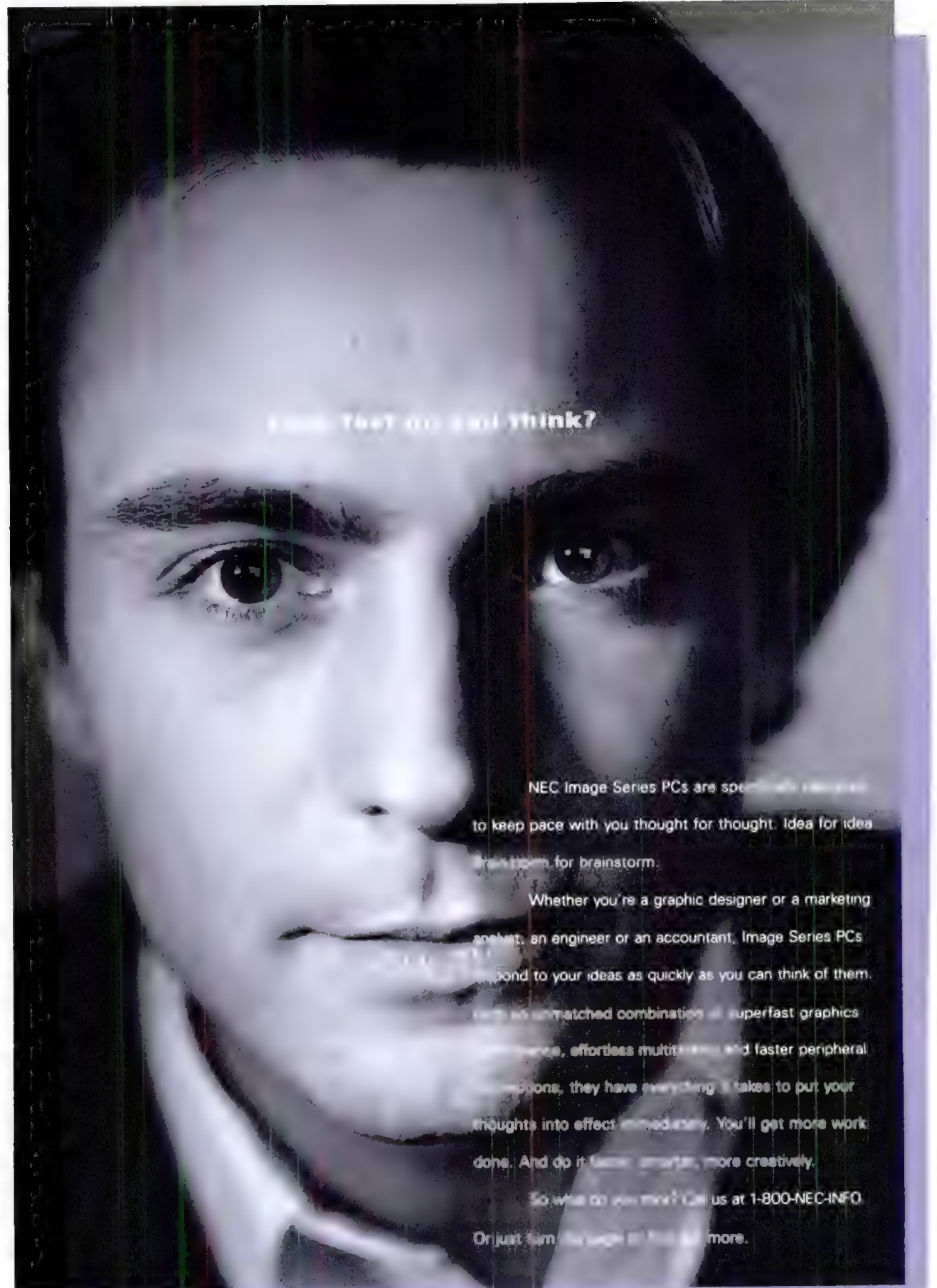
In both the Choose Color dialog and the Choose Font dialog, I save the user's choices in files, using the iostream library, so they are preserved from one program run to another. Figure 9 shows the code that does this. Notice that the part of the program that recovers the color information from the color.val file is shorter than the code that initializes the CHOOSECOLOR struct.

The iostream library is a convenient, flexible, and reliable tool that should be a part of every C++ user's armory. It's well worth the effort to learn, and once you master it you'll find many occasions to put it to good use. □

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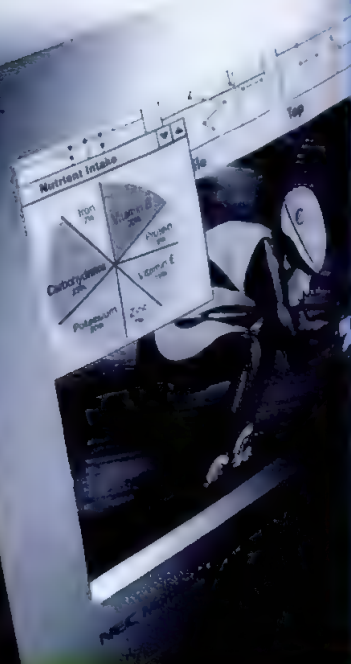


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NEC

Utilities

BY BOB FLANDERS AND MICHAEL HOLMES

Decompress Files With PCDEZIP

If you've been using our PCUNZIP (Utilities, March 31, 1992) to decompress the files you download from ZiffNet, it's time to upgrade to the new PCDEZIP. Phil Katz has released Version 2.0 of his popular shareware compression program, PKZIP, and our old utility can't decompress the newly zipped files. The new PCDEZIP will unzip files zipped with either version of PKZIP.

Although we have added some valuable new features to PCDEZIP, our attempt has not been to duplicate all the capabilities of the commercial product. PCDEZIP does not, for example, permit using wildcard characters in the .ZIP filename, handle files that span more than one floppy disk, preserve read-only file attributes, or decrypt encrypted files. To get these facilities—and, of course, to be able to zip files yourself—you must obtain the full-scale PKZIP, which is available from PKWare. Our aim here is simply to provide our readers with a no-cost way to decompress ZiffNet files.

You can get a copy of PCDEZIP by downloading PCDEZIP.EXE from ZiffNet, as explained in the sidebar "Guide to Our Utilities & How to Get Them." After downloading, you should rename the file PCDEZIP.EXE. To study or change the source code, download the self-extracting archive file PCDZ.EXE.

After running PCDZ.EXE, you can use the included C.BAT batch file in order to compile the program. The parameter that you supply to C.BAT specifies the compiler you're using. To compile with Borland C++ 3.1, Borland Turbo C++ 3.0, or Microsoft C/C++ 7.0 (or later), use the parameters C B, C T, or C M, respectively. If you don't supply a

compiler parameter, C.BAT assumes Borland C++ 3.1.

If you don't have a modem, you can obtain the same files by sending a postcard with your name, address, and preferred disk size to Public Brand Software, P.O. Box 51315, Indianapolis, IN 46251; fax 317-856-2086.

USING PCDEZIP The full command line syntax for PCDEZIP is

```
PCDEZIP [switches] zip_file
[target\] [filespec [...]]
```

Entered without any of its optional parameters, the command

```
PCDEZIP zip_file
```

simply decompresses the contents of the named .ZIP file and places them into your current directory. You do not need to enter the .ZIP extension; PCDEZIP

assumes it unless you specify otherwise.

If the .ZIP file is not in your current directory, you have to provide the path to it. For example, if SOURCE.ZIP is in your D:\PROJECT directory, then the command

```
PCDEZIP D:\PROJECT\SOURCE
```

will expand SOURCE.ZIP and put its files into your current directory.

You can select a different target directory by using PCDEZIP's *target* option. To specify a target directory, you type in the directory pathname as the argument directly following the .ZIP file to be processed. Note that the target argument must end with a backslash, because this is how PCDEZIP identifies it as a directory. Thus, to put the decompressed contents of the SOURCE.ZIP file shown above into E:\JOB, you would enter

```
PCDEZIP D:\PROJECT\SOURCE E:\JOB\
```

If the target directory you desire does not already exist, you can instruct PCDEZIP to create one for you, unless the .ZIP file already contains its own directory information. (.ZIP files that do contain such information are created with the *-apr* option of PKZIP and are considered below in the section, "Restoring Directories.") To do this, you make use of the */D* switch in conjunction with the *target* option. Assuming that SOURCE.ZIP is an ordinary .ZIP file that contains no stored directory information and that you want to create the JOB directory on drive E:, the command would be

```
PCDEZIP /D D:\PROJECT\SOURCE E:\JOB\
```

The six optional switches that PCDEZIP supports are listed and briefly explained in Figure 1. This figure shows the help message that is displayed when you enter PCDEZIP without any arguments. The command line switch may actually be placed either before or after the *zip_file* entry. Like the command line switches of other PC Magazine utilities, the switches for PCDEZIP are identified by a slash (/). For readers more accustomed to the syntax of the commercial PKUNZIP, a hyphen (-) may be used in place of the slash, except when the switch

Top 10 Utilities

Rank	Utility
1	INCTRL - Installation control
2	CLIPST - Extends the clipboard
3	CHANGER - Changes look of desktop
4	WINCMD - Command file interpreter
5	RCLICK - Puts menu bars at cursor
6	FNTPRN - Catalogs your fonts
7	WINTIDY - Organizes program manager
8	BUGS - Windows 3.1 screen saver
9	WPRINT - Prints in Windows 3.1
10	WTIME - Keeps PC clock accurate

This list is based on the total number of downloads each utility has had on PC MagNet over the past 12 months. To download these files, type GO ZNT:TIPS. For more information, see the sidebar "How to get PC Magazine's Utilities."

PCDEZIP's Syntax

```
usage: PCDEZIP [switches] zipfile [target\] [filespec [...]]

switches: -f  freshen existing files
          -n  extract new and updated files
          -o  do not prompt on overwrite
          -v  view ZIP directory
          -d  create directories
          -t  test file integrity

zipfile   is source .ZIP file

target\   is the target directory; trailing backslash required

filenames are files to be extracted; wildcards supported
```



Figure 1: When you enter PCDEZIP with no parameters, it displays its syntax and switches as shown here.

is placed after *zip_file*. Only the slash can be used if the switch parameter follows the name of the file to be decompressed.

Three of the PCDEZIP switches, /F, /N, and /O, allow you to eliminate the utility's overwrite prompt. Before PCDEZIP decompresses a zipped file, it checks to see whether there is a same-named file in the destination directory. If so, PCDEZIP normally displays the filename, the DOS directory information for both files, and the message, "Overwrite existing file? (Y/n/all/stop)". Press Y to replace the file, N to skip that file, A to overwrite both it and all subsequent files without further prompting, and S to stop the utility and return to DOS.

The /F switch freshens existing files. That's to say, it decompresses *only* those files that have an older, same-named version in the destination directory. When the /F is specified, any same-named but earlier-dated files are automatically overwritten. The /N (newer) switch unzips the same files as /F but also adds any files that do *not* have a same-named version in the destination directory. Specifying this switch will not overwrite any later-dated, same-named files, however. The /O switch tells PCDEZIP to overwrite any existing same-named files without regard for their date and without prompting for confirmation. Use this switch with care!

You can test the integrity of a .ZIP file with the /T (test) switch. When you specify the test switch, PCDEZIP performs a complete decompression operation on each requested file but creates no output files. If an error is detected, PCDEZIP displays an error message next to the file that contains the error.

You can view the contents of a .ZIP

file without decompressing it by employing the /V switch. Frequently, your reason for wanting to use this switch is that you wish to unzip only one or two specific files from the .ZIP files. This is done by using PCDEZIP's *filespec* option.

Suppose, for example, that you have a .ZIP file named DATA.ZIP in the root directory and you enter the command

```
PCDEZIP /V \DATA
```

Figure 2 shows the hypothetical contents of this file in the same way that /V displays them. Notice that in this instance, the .ZIP file contains not only compressed files but directory information as well. Specifically, the INCOME.DAT and INCOME.IDX files are prefaced with directory names, although INDEX.DAT stands alone. If your interest is in decompressing only INDEX.DAT, you would use the *filespec* argument in order to specify the file you wanted by entering the command

```
PCDEZIP \DATA INDEX.DAT
```

Note that as shown in the syntax line above, the *filespec* argument may be used to specify more than one file. This option also supports the use of wildcards.

RESTORING DIRECTORIES When creating a .ZIP file, PKZIP can optionally store the pathname along with the filename. In Figure 2, PKZIP used the directory tree seen in Figure 3 to put all the files in all of the subdirectories below the \ACCT directory into \DATA.ZIP.

Preserving the directory structure stored in a .ZIP file while expanding its files is the other of the two jobs of PCDEZIP's /D switch. To restore the contents and structure of the \ACCT directory tree, you would use the commands

```
CD \ACCT
PCDEZIP /D \DATA
```

If the /D switch is specified when PCDEZIP searches through the .ZIP file, it creates any directories whose names have been stored as part of the compressed files. Thus, when PCDEZIP encounters 1991\INCOME.DAT, it looks first to see whether the 1991 directory exists in the current (\ACCT) directory. If not, PCDEZIP creates such a directory before restoring 1991\INCOME.DAT.

If you don't specify the /D switch, PCDEZIP will, by default, attempt to put every file in \DATA.ZIP into your current directory. This could be a problem. For example, if you issued the command

```
PCDEZIP \DATA
```

Viewing a .ZIP File's Contents

```
Processing: DATA.ZIP
```

Length	Method	Size	Ratio	Date	Time	Name
0	stored	0	0%	09-16-93	11:03	1991\
0	stored	0	0%	09-16-93	11:03	1992\
0	stored	0	0%	09-16-93	11:03	1993\
16826	deflated	3930	77%	09-15-93	15:30	1991\INCOME.DAT
4387	deflated	1770	60%	08-26-93	9:39	1991\INCOME.IDX
18650	deflated	7480	60%	09-14-93	20:23	1992\INCOME.DAT
6949	deflated	2751	61%	09-16-93	10:48	1992\INCOME.IDX
9017	deflated	2197	76%	09-15-93	15:12	1993\INCOME.DAT
2006	deflated	841	58%	09-16-93	10:42	1993\INCOME.IDX
392	deflated	174	56%	09-16-93	11:04	INDEX.DAT
-----		-----	-----			----
58227		19143	68%			10

```
PCDEZIP completed normally
```

Figure 2: Entering PCDEZIP with the /V switch displays the contents of a .ZIP file.

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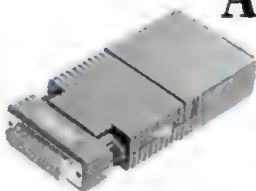
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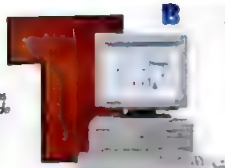
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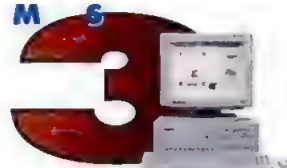


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ACCT	1991	INCOME.DAT INCOME.IDX
	1992	INCOME.DAT INCOME.IDX
	1993	INCOME.DAT INCOME.IDX
		INDEX.DAT

Figure 3: In creating DATA.ZIP, PKZIP used its -apr option to capture the subdirectory tree for the \ACCT directory.

PCDEZIP will place INCOME.DAT and INCOME.IDX into the current directory by decompressing the contents of 1991\INCOME.DAT and 1991\INCOME.IDX, respectively. When PCDEZIP then finds INCOME.DAT and INCOME.IDX in the .ZIP file's \1992 directory, however, it will again try to decompress the files into the current directory.

Since same-named files are now found there and you did not specify the /O switch, PCDEZIP will ask whether you want to overwrite these just-decompressed files. The same thing will happen with the \1993 files. This problem is avoided by using the /D switch to recreate the original directory structure that was stored in the .ZIP file by using PKZIP's -apr option.

The *filespec* option can be combined with the /D switch. Thus, if you wanted to decompress all the .DAT files and restore them in their original directories, you would use the commands

```
CD \ACCT
PCDEZIP /D \DATA *.DAT
```

This will unzip 1991\INCOME.DAT, 1992\INCOME.DAT, 1993\INCOME.DAT, and INDEX.DAT. Since the /D switch was specified, the associated directories will be created as necessary. Further, since /O was not specified, PCDEZIP will prompt before overwriting any existing file.

The *filespec* argument can also specify the directory portion of the file desired. For example, to unzip 1991\INCOME.DAT, you would enter the following:

```
PCDEZIP /D \DATA 1991\INCOME.DAT
```

Again, the presence of the /D switch tells PCDEZIP to create the 1991 directory that contains INCOME.DAT. If you don't use this switch, PCDEZIP will put INCOME.DAT into your current directory.

As with DOS commands, however, PCDEZIP

cannot accept wildcards in the path portion of the *filespec* argument. For example, you would unzip all of the files in the \1992 directory (creating that directory if necessary) with the command

```
PCDEZIP /D \DATA 1992\*.*
```

If you wanted to unzip all the files in only the 1991, 1992, and 1993 directories, however, you might be tempted to use the command

```
PCDEZIP /D \DATA 199?\*.*
```

This attempt would fail, however, because you cannot specify a wildcard as part of a subdirectory definition. Since PCDEZIP does not decode wildcards used in the path portion of the filename arguments, it will not match 199? with any of the directories. To unzip the desired files, you must instead use the command

```
PCDEZIP /D
\DATA 1991\*.* 1992\*.* 1993\*.*
```

EMPTY DIRECTORY PROCESSING When PKZIP builds a .ZIP file, it adds entries that note the existence of empty directories. This feature is needed to allow the complete restoration of a file system or subdirectory tree. Although an empty directory may seem useless, it sometimes serves as an important placeholder for temporary files that are deleted when a program finishes executing.

As indicated above, when you specify the /D switch, PCDEZIP recreates the directory structure contained in the .ZIP file. However, PCDEZIP creates directories only as needed. If you have a .ZIP

file named TEMP.ZIP containing DIR1\INFO.DAT and DIR2\NOTES.TXT and issue the command

```
PCDEZIP /D TEMP
```

PCDEZIP will create both the \DIR1 and \DIR2 directories to hold INFO.DAT and NOTES.TXT, respectively.

If instead you enter

```
PCDEZIP /D TEMP *.*.TXT
```

however, PCDEZIP will create only \DIR2, since that is what is needed to hold NOTES.TXT. The \DIR1 directory would not be created because INFO.DAT was not unzipped from the .ZIP file.

This would seem to preclude the creation of empty directories, since PCDEZIP never has a need to create them. You can, however, force PCDEZIP to create empty directories by using *.* as the *filespec*. Moreover, if you do not specify a *filespec* argument, PCDEZIP uses the *.* specification by default.

INSIDE PCDEZIP Fortunately, there's no need to enter into the monumental complexities of data-compression schemes. From PCDEZIP's point of view, how the data gets encoded is of little importance: PCDEZIP simply wants to return the contents of the .ZIP file in usable form. To do so, PCDEZIP must understand the .ZIP file format, scan the .ZIP file to find the files that must be decompressed, and apply the appropriate decompression algorithms to the compressed data.



Figure 4: The general layout of a .ZIP file.

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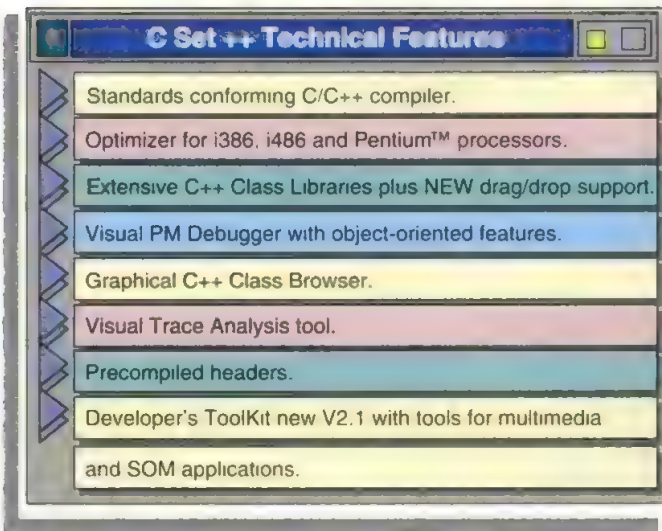
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PC TECH Utilities

PCDEZIP starts by performing initialization chores such as installing a control-break vector, saving the starting drive and default directory, scanning the command line arguments, and opening the requested .ZIP file. Then the real work begins.

The first step is to look for compressed files within the .ZIP file. This will be discussed below in the section entitled, "The Zip File Format." As it encounters each file, PCDEZIP determines whether the file should be decompressed by checking the filenames supplied on the command line the switches supplied (/F, /N, and /O), whether the file already exists, the date and time on the existing file, and the answer supplied to any overwrite prompts solicited by PCDEZIP. If PCDEZIP disqualifies the file, it moves on to the next file in the .ZIP file.

If PCDEZIP determines that the file should be decompressed, it then opens the output file. If the /D switch was found on the command line, this process includes building any required directories. Once the output file is open, PCDEZIP decompresses the data and writes the resultant information to the output file.

As decompression progresses, PCDEZIP checks the output file's integrity by using a cyclic redundancy check (CRC). When the .ZIP file is created, the CRC value is calculated using every byte in each of the original, uncompressed files. This value is stored in the .ZIP file. If even a single byte of the decompressed file differs from the original file, the CRC will be different, and PCDEZIP will declare an error in the decompressed file. PCDEZIP then searches for the next file to decompress until it reaches the end of the .ZIP file.

THE ZIP FILE FORMAT If you've ever displayed the contents of a .ZIP file with DOS's TYPE command, you've probably noticed that the file's apparently unintelligible contents begin with the letters PK. In fact, if you look through the contents of a .ZIP file carefully, you'll find the letters PK scattered about in several places. That's because these letters—the initials of PKZIP's creator, Phil Katz—form the first 2 bytes of the signature fields used in the structures that describe the .ZIP file's contents.

Specifically, two structures are used to

describe compressed files in a .ZIP file: the local file header and the central directory. The local file header immediately precedes the compressed data for the file it describes. The signature of the local file header is PK,3,4, where the PK are characters and the 3 and 4 are binary values in the subsequent bytes. (For a fast comparison of the signature value, PCDEZIP reads the 4-byte signature and compares the resulting value against a long value of 0x04034b50. Since Intel microprocessors store values with the least significant byte in the lowest memory address, this value is reversed from the way it would be viewed in a dump of the file.)

The local file header contains several fields. These fields include the filename, compressed file size, uncompressed file size, CRC value, and a value that indicates the compression algorithm used to compress the file. Curiously missing from the local file header is the attribute byte for the file.

The central directory, which comes after all of the compressed file data, is made up of the main file header and an end-of-central-directory record. This file header contains all of the data found in the local file headers together with the file attributes and a pointer to the local file-header structure. The signature for the main file header is PK,1,2, or 0x02014b50.

The third structure found in the .ZIP file is the end-of-central-directory record. Its signature is PK,5,6 (0x06054b50). There is only one of these per .ZIP file, and it immediately follows the last file header. Figure 4 shows the general format of a .ZIP file.

Of these three structures, PCDEZIP uses only the local file header. (This is why PCDEZIP cannot preserve the original file attribute and must decompress all files as read-write.) When PCDEZIP finds a local file header, it uses the information there to determine whether the file should be decompressed and if so, what method to use to decompress the associated file. PCDEZIP recognizes the existence of the file header and end-of-central-directory records, but it skips them in search of more local file-header structures.

When you test a .ZIP file using the /T switch, PCDEZIP performs a full extract

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and decompress function but does not write the decompressed information to disk. Instead, the purpose of the extraction is to calculate and compare the CRC against that of the original file. If the CRC does not match, PCDEZIP issues a message that the file may be corrupt.

Viewing the contents of the .ZIP file is a significantly different process. When you view a file (using /V), PCDEZIP

searches the file for local file headers and prints the contents as they are encountered. After displaying the information, PCDEZIP skips over the compressed data and searches for another header until the end of file is reached.

With PCDEZIP, you can confidently download files compressed with PKZIP, Version 2.0. The new utility even adds to the capabilities of the obsolete PCUN-

ZIP. We hope this makes up for the inconvenience of switching your decompression software. □

BOB FLANDERS AND MICHAEL HOLMES ARE PRESIDENT AND VICE PRESIDENT OF NCI SYSTEMS AND THE AUTHORS OF PC MAGAZINE C LAB NOTES AND C COMMUNICATIONS UTILITIES, PUBLISHED BY ZIFF-DAVIS PRESS.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

PCDEZIP

PURPOSE: Extracts the contents of .ZIP files downloaded from ZiffNet. PCDEZIP replaces the earlier PCUNZIP utility in order to achieve compatibility with Version 2.0 of PKZIP. The new utility is compatible with both versions of PKZIP and provides additional switches and targeting options.

FORMAT: PCDEZIP [switches] zip_file [target\
[filespec [. . .]]

REMARKS: The *zip_file* specified may contain a pathname. By default, PCDEZIP decompresses files into the current directory, but an alternative destination may be specified with the *target* option. Note that when this option is used, the target destination must always contain the trailing backslash shown. The *filespec* option, which supports wildcards, permits naming specific files to be extracted from the .ZIP file. A help screen, obtained by entering PCDEZIP at the command prompt with no *zip_file* argument, briefly explains the utility's six switches, which are identified by being preceded with a / or a - character.

The /F switch extracts only files that have an older version (which will be overwritten) in the destination directory. The /N switch extracts these and any files that do not have later-dated versions in the destination directory. The /O switch decompresses all of the files in the .ZIP file and automatically overwrites any same-named files without regard to their date. These three switches disable the normal warning prompt.

The /V switch permits viewing the contents of a .ZIP file without extracting any files, and the /T switch tests the integrity of the *zip_file*. The /D switch recreates any directory structure stored in the .ZIP file. When no directory information is stored, the /D switch permits the creation of a new destination directory when a *target* argument is also specified.

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HOW TO JOIN ZIFFNET Dial the local access number. At the HOST NAME prompt, enter CIS. At the USER ID prompt, type 177000.5000. When you see the PASSWORD prompt, enter PC*MAGNET. Finally, when you see the ENTER AGREEMENT NUMBER prompt, enter PCMAG93. Current CompuServe members can type GO PCMAG at any CompuServe ! prompt. Once you enter your billing information, you'll see your personal user ID and temporary password. A new password will arrive by mail within ten days.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

PCs

SHOCKING YOUR SYSTEM

❓ I've experienced intermittent problems with static electricity in my computer. Am I correct that zaps from my hands could be the cause of hardware malfunctions, and if so, what can I do to prevent them?

David Jacobson
Beijing, China

► **PC MAGAZINE:** Yes, static electricity can indeed wreak havoc on the insides of your computer. While there is little power behind the shocks, the thousands of volts contained in these sparks can jolt the sensitive electronic components, sometimes causing permanent damage. The problems are usually most severe in cold weather when the heat is on.

Increasing humidity and getting rid of carpeting will solve the problem, but these aren't always practicable solutions. Fortunately, there's a much simpler answer. Take a bottle of fabric softener and dilute it with about ten parts tap water. Put the mixture in a spray bottle and apply it to the carpet around your work area. You may find the fragrance a bit strong at first, but it soon fades. One application lasts about six months. You can buy sprays designed specifically for this purpose, but the fabric softener works just as well for only a fraction of the price.—*Alfred Poor*

QUIETER FANS

► **PC MAGAZINE:** The typical desktop computer has relatively few mechanical components that can wear out with use, but one of the most annoying is the cooling fan in the power supply. When the

fan's bearings start to go, they can make a rumbling sound that rivals a Boeing 747 on takeoff. The fan itself is a relatively low-cost item, but you typically have to replace the entire power supply to fix the problem, which can cost \$100 or more, depending on the power supply's size.

There's another way to solve the problem—at least for the short term—for just pennies. Open the case and remove the machine screws that hold the power supply in place. Then reinstall the screws, placing rubber grommets between the power supply and the case. This will absorb most of the vibrations and will reduce the sound level significantly. You should still plan on replacing the power supply, since your system will overheat if the fan stops, but this will let you work without earplugs.—*Alfred Poor*

Operating Environments

CONTROLLING PRINTER OUTPUT

❓ The batch file I'm using to control my new sheet-feeder ends with the command

```
ECHO ^L > PRN
```

Although no carriage-return/line-feed pair follows this statement, the feeder is somehow receiving such a sequence. I had experienced a similar problem when attempting to send a form-feed from QuickBASIC, until I put a semicolon after the offending command to terminate the problem. Hoping for the same effect, I even added a ^Z to the end of my batch file, but it made no difference. What's wrong?

Virgil V. Perkins
Bourbon, Missouri

► **PC MAGAZINE:** Your difficulty stems from the ECHO command itself, not from the presence (or absence) of a carriage-return/line-feed (CR/LF) at the end of the line. ECHO always sends a CR/LF so that, if used repeatedly, its output will appear on separate lines. QuickBASIC's PRINT does the same unless you tell it otherwise by following the command with a semicolon.

A simple DEBUG session provides one solution to your problem. Enter the command `DEBUG FORMFEED.DAT`. DEBUG will respond "File not found" and present its hyphen prompt. Type `E 100 0C` (0C is the form-feed character represented in hexadecimal). Press the Enter key and DEBUG will store 0C at mem-

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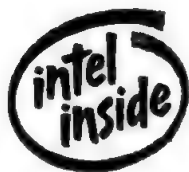
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ory location 100 and display the hyphen again. Type RCX and, after you press the Enter key this time, DEBUG will display CX *nnnn* (where *nnnn* is a four-digit hex number that shows the contents of the processor's CX register). Then, on a new line, DEBUG will present a colon prompt. Type 1, press the Enter key and you'll be back at the hyphen. Now type W and press the Enter key, and DEBUG will write your 1 stored byte (0C) to the file FORMFEED.DAT. Quit by typing Q and hitting the Enter key. Now any time you want to send a form-feed to the printer—but no CR/LF—use the command COPY FORMFEED.DAT PRN.

—Neil J. Rubenking

DOS'S TRUENAME COMMAND

❓ I recently discovered DOS 5.0's TRUENAME command, which—when issued without parameters—returns the current drive and path. Enter a filename as an argument and you'll get the full pathname back. If, for example, TRUENAME alone yields C:\DOS, then TRUENAME FDISK.COM would produce C:\DOS\FDISK.COM. Unfortunately, my manual fails to document this com-

mand. What purpose does it serve?

Jim Zarifis

New Rochelle, New York

► **PC MAGAZINE:** The internal DOS function invoked by TRUENAME has been around since DOS 3.0 and the command itself appeared—undocumented—in DOS 4.0. TRUENAME provides a way to see through the false names created by the DOS commands SUBST, ASSIGN, and JOIN. SUBST allows a subdirectory to pose as a drive, ASSIGN lets one drive pretend to be another, and JOIN makes one drive appear to be a

subdirectory of another drive. TRUENAME exposes this subterfuge.

If, for example, you've used a command like SUBST I: C:\PROGRAMS, the command TRUENAME I: will return C:\PROGRAMS. TRUENAME I:\WHEREIS.COM will return C:\PROGRAMS\WHEREIS.COM—*regardless* of whether WHEREIS.COM actually exists!

TRUENAME also cleans up the filename you pass it, forcing all characters in the name and extension into uppercase and stripping off any extras. For example, the command TRUENAME c:\dos\way-toolong.Thistoo returns C:\DOS\WAYTOOLO.THI.—Neil J. Rubenking

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

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Douglas Belling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.

Frank J. Dorfler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity*.

Alfred Poor is a contributing editor and the author of *New Life for Old PCs*.

Jeff Pressie is a contributing editor and the author of the *PC Magazine Guide to DOS 5 Memory Management*.

Sai Ricciardi is a contributing editor and the author of the recent *Running FoxPro* books from Microsoft Press.

Neil Rubenking is technical editor and author of *Can Do DOS*,

Can Do Windows, and *PC Magazine Batch File Lab Notes*.

Joe Salemi is a contributing editor and the author of the *PC Magazine Guide to Client/Server Databases*.

Luisa Simone is a contributing editor and the author of the book *Microsoft Publisher*.

Craig Stinson is a contributing editor and coauthor of *Running Windows 3.1* and *Running Microsoft Excel*.

M. David Stone is a contributing editor and coauthor of *Word for Windows Companion*, Second Edition.

Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*.

Spreadsheets

INTERPOLATING LOOKUP VALUES IN EXCEL

❗ **TIP** I have created a macro that improves upon the Excel lookup functions by interpolating values when necessary. Suppose you are doing research in which you have to measure temperatures but are using a thermocouple. The thermocouple gives an output in millivolts, which you must look up in a table and convert to degrees Fahrenheit.

The following abridged table will help demonstrate:

Millivolts	Temperature
-0.463	10
-0.442	10.1

If your thermocouple reading is -0.451 and you use the standard VLOOKUP

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function, Excel returns 10. With my macro, a thermocouple reading of -0.451 returns 10.0571429, a value interpolated between 10 and 10.1.

The macro, named Intlookup and listed in Figure 1, is a user-defined function requiring three arguments. The first argument is the location of the lookup table. The next argument is the value you would like to seek out. This is -0.451 in the example above. The third argument is the column where the interpolation is to occur. In the example above, this would be 2. This argument is included so that you don't have to build separate tables when there are more properties, such as pressure or density, which are also dependent upon millivolts.

So in the example above, if the lookup table were named Table, you could find the temperature corresponding to -0.451 millivolts by entering

```
=INTER.XLM!Intlookup(Table  
-0.451,2)
```

It's very important for the first column

of the table to be sorted in ascending order. The macro uses a binary search, which means it starts by setting pointers to the beginning and end of the first column of the table and then calculates a midpoint. If the search value (the second argument) is greater than the value contained at the midpoint, then the lower pointer takes on the value of the midpoint. Otherwise, the higher pointer takes on the value of the midpoint, and the search continues.

The biggest drawback to the macro is that it operates slowly. But it works, and it's much faster than doing the calculation by hand.

*Jason Wessels
New Orleans, Louisiana*

► **PC MAGAZINE:** Lookup tables are typically used in situations where interpolation would not be appropriate. For example, the VLOOKUP function is often employed in payroll worksheets to calculate withholding tax. The withholding tables issued by the IRS consist of a series of threshold values. If wages are greater

than x but less than y , the amount withheld is z . You certainly don't want to do any interpolating in this context; you want to withhold the lower-threshold amount.

In situations where two sets of values have a perfectly linear relationship to one another, you don't need a lookup table at all. For example, you don't need VLOOKUP to convert Celsius temperatures to Fahrenheit; a simple formula will do the job.

But for certain kinds of engineering problems, where the relationship between input and output is not definable by formula but based on experimentally derived values, an interpolating lookup function, such as Mr. Wessels's Intlookup, can be quite useful.

The macro does its binary search routine until it has found the highest lookup-table number less than the search value and the lowest lookup-table value greater than the search value. It gets the numbers that VLOOKUP would return for each of these positions in the lookup table, then does some straightforward

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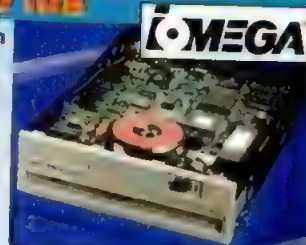
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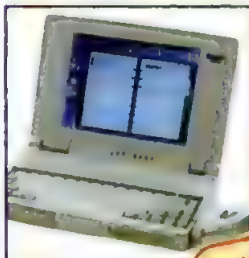
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	A	B	C
1	Intlookup		
2	=ARGUMENT("table",84)		
3	=ARGUMENT("value")		
4	=ARGUMENT("which")		
5	=IF(VLOOKUP(value,table,1)=value,GOTO(A24))		
6	=SET.VALUE(B6,1)	2	← low value
7	=SET.VALUE(B7,ROWS(table))	4	← high value
8	=SET.VALUE(B8,INT((B7-B6+0.5)/2)+B6)	3	← midpoint
9	=IF(INDEX(table,B6,1)=value,RETURN(INDEX(table,B6,which)))		
10	=IF(INDEX(table,B7,1)=value,RETURN(INDEX(table,B7,which)))		
11	=IF(AND(INDEX(table,B8,1)<value,INDEX(table,B8+1,1)>value),GOTO(A18))		
12	=IF(AND(B8+1=B7,B6+1=B7),RETURN("Not in table"))		
13	=IF(INDEX(table,B8,1)<value,GOTO(A14),GOTO(A16))		
14	=SET.VALUE(B6,B8)		
15	=GOTO(A8)		
16	=SET.VALUE(B7,B8)		
17	=GOTO(A8)		
18	=INDEX(table,B8,1)		value1
19	=value		value2
20	=INDEX(table,B8+1,1)		value3
21	=INDEX(table,B8,which)		value4
22	=INDEX(table,B8+1,which)		value5
23	=RETURN(A21+(A22-A21)*(A19-A18)/(A20-A18))		
24	=RETURN(VLOOKUP(value,table,which))		

Figure 1: You can use the Intlookup function this macro creates to interpolate Excel lookup table values.

	A
1	Intlookup
2	=ARGUMENT("table",8)
3	=ARGUMENT("value")
4	=ARGUMENT("which")
5	=IF(OR(value<INDEX(table,1,1),value>INDEX(table,ROWS(table),1)),RETURN("Not in Table"))
6	=IF(VLOOKUP(value,table,1)=value,RETURN(VLOOKUP(value,table,which)))
7	=SET.NAME("Low",1)
8	=SET.NAME("High",ROWS(table))
9	=SET.NAME("Midpoint",INT((High-Low+0.5)/2)+Low)
10	=WHILE(NOT((AND(INDEX(table,midpoint,1)<value,INDEX(table,midpoint+1,1)>value))))
11	=IF(INDEX(table,midpoint,1)<value,SET.NAME("Low",midpoint),SET.NAME("High",midpoint))
12	=SET.NAME("midpoint",INT((High-Low+0.5)/2)+Low)
13	=NEXT()
14	=INDEX(table,midpoint,1)
15	=value
16	=INDEX(table,midpoint+1,1)
17	=INDEX(table,midpoint,which)
18	=INDEX(table,midpoint+1,which)
19	=RETURN(A17+(A18-A17)*(A15-A14)/(A16-A14))

Figure 2: This faster variation of the macro in Figure 1 eliminates some repetitive checking.

arithmetic to arrive at the appropriate interpolated value.

A somewhat tighter version of this macro is listed in Figure 2. Both versions of the macro check to see whether the value being looked up lies outside the range of the table. If it does, the function returns the text string "Not in table." Both versions also check to see if the lookup value has an exact match in the first column of the table. If such a match exists, the macro simply performs a normal VLOOKUP. The principal difference between the two versions is that the one in Figure 2 checks for both of these conditions up front before the binary search begins. In Figure 1, the out-of-

bounds check falls within the binary search routine, causing the macro to repeat the check unnecessarily on each search iteration. Eliminating this extra labor will speed the macro up a bit.

I've also replaced the GOTOs in Figure 1 with a WHILE/NEXT loop, making the macro's structure a little easier to discern. And I've replaced Mr. Wessels's SET.VALUE statements with SET.NAME statements, as a matter of personal preference. SET.VALUE stores a value in a specified cell on the macro sheet. SET.NAME creates a variable in memory without affecting any macro-sheet cells. The result is the same, except that SET.NAME is automatically self-

documenting. If you use SET.VALUE instead, it's a good idea to name the cells into which you are setting values rather than using row-and-column references. That way you'll have an easier time figuring out what's going on when it comes time to revise your macro.

As with any other user-defined function, you can make this one a little easier to use by saving the macro sheet as an .XLA file and storing the file in your XLSTART directory. That way the function will be available at every session, and you won't have to type the name of the sheet as a prefix to the function name.

—Craig Stinson

Databases

EXPAND STRINGS FOR REPORT HEADINGS

TIP I needed a function that would insert a space between each character of a string to expand it for use as a title in a report.

I came up with the Clipper user-defined function

```
FUNCTION xpand( str )
RETURN TRANSFORM(str, "OR " + ;
    REPLICATE("X ", LEN( str )))
```

You can call the function as follows:

```
? xpand("PERSONNEL REPORT")
```

and it will display

```
P E R S O N N E L   R E P O R T
```

You could also write a version where a second optional parameter would be the character to use instead of a space (it would still default to a space if no second parameter were entered):

```
FUNCTION xpand( str, ch )
IF (ch==NIL)
    ch := " "
ENDIF
RETURN TRANSFORM(str, "OR " + ;
    REPLICATE("X " + ch, LEN(str)))
```

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```
? xband(*SENSITIVE*, ***)
```

produce

```
S*E*N*S*I*T*I*V*E*
```

Rob Williams
Los Angeles, California

► **PC MAGAZINE:** This could be useful for placing headings on a report or at group levels. The TRANSFORM() function is used to format data according to a template, just like the PICTURE and FUNCTION clauses for the @...SAY and @...GET commands. To use it, you pass it a value and a template. In Mr. Williams's xband() functions, most of the time is spent constructing the template, so let's discuss templates first.

A template for a TRANSFORM() function can consist of a series of *picture codes* that define the format and range of acceptable values for each individual character position. For example, a picture code of 9 means the character at that position must be numeric, A means it must be alphabetic, and an X accepts any character. (The number of picture codes and their meaning depends on your Xbase implementation.)

The template can also contain *function codes*, which apply to the entire value rather than to individual character positions. For example, a function code of ! converts all alphabetic characters to uppercase throughout the value, and a function code of Z displays a zero value as blank spaces. If you use both picture codes and function codes in a template, the function code must be preceded by an @ symbol, followed by a space, and must precede the picture codes. For example, "@Z 9999" is a valid template that uses a function and picture code.

In the first xband() function, the template that's constructed consists of "@R" followed by a series of "X" pairs (note the space). The REPLICATE() function is used to insert one X-and-space pair for each character in the string passed as a parameter to xband(). For example, the template for the string "PC" would be "@R X X". Notice the presence of a space after each X. Unlike the X, a space is not a valid template character and normally would be overwritten. However, the

■ Tips at Your Fingertips!

Two files of interest to PC Solutions readers are now available on ZiffNet:

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Both files are formatted as Windows Help files. ZiffNet members can download the files from *PC Magazine's* TIPS forum (GO TIPS), General Info section (LIB 1).

presence of the @R function code tells the TRANSFORM() function to insert any invalid template characters that it finds into the output instead. This is what allows the second xband() function to insert the character in the variable ch (entered as a second parameter) after each letter in the input string.

—Sal Ricciardi

► Graphics

CONVERTING DOTS TO LINES

❓ I have a Hewlett-Packard HP ScanJet IIp scanner, and I'd like to scan drawings and then transfer them to AutoCAD for further editing. Can you provide some information on raster-to-vector conversion software?

Miguel Velez
Las Loma, Puerto Rico

► **PC MAGAZINE:** Converting raster data to a vector format is both a commonplace and a complex procedure, which means you'll find a great number of raster-to-vector utilities on the market that differ widely in both price and functionality.

Unlike raster-to-raster or vector-to-vector conversions (which translate one file format to another), raster-to-vector operations require the software to have a fair amount of intelligence. Remember that raster—or bitmap—pictures are simply collections of dots. The computer can't distinguish the dots that form a circle from the dots that form a square. So in order to transform a collection of dots into a collection of objects (all vector files are object-oriented), the software program must recognize—or trace—shapes and lines. That's the reason raster-to-vector conversion utilities are also called

autotracing programs.

If you're scanning small simple outlines, you probably already own an autotracing utility. Autotracing is a function that is commonly built into or bundled with vector drawing programs. Micrografx Designer (\$695, 800-676-3110) and Deneba's Canvas (\$399.95, 305-596-5644) are two examples of programs with built-in tracing tools. Their bare-bones tracing functions use color boundaries to identify straight lines, curves, and object outlines. For example, black dots are converted to outlines and white dots are treated as background.

If you want to autotrace more complex images, you'll find that CorelTrace (\$595 bundled with CorelDRAW 4.0, 800-836-3729) and Adobe Streamline (\$695 bundled with Adobe Illustrator, or \$195 as a standalone product, 800-2272-3623) are more than up to the task. Indeed, both of these programs are quite sophisticated. They have the ability to trace everything from black-and-white to grayscale to full-color images. And a host of configuration options allow you to control various aspects of the scanning process, such as whether the program produces closed shapes (outline) or open lines (centerline). You can also choose to ignore artifacts introduced during the scanning process by filtering out noise. And you can create more accurate and efficient tracings by altering the ratio of curves to straight lines. Figure 3 shows some of the intelligence in Adobe Streamline. Note the Line Recognition option, which can convert lines that have been skewed during the scanning process and automatically draw them as perfectly horizontal or vertical objects.

All of the programs I've mentioned so far are suitable for your purposes because they import standard raster files,

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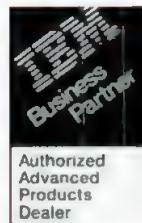
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Model	Clock Speed	Hard Drive/Ave. Access	ISA Slots	3.5"/5.25" Bays	Video RAM	DOS Version	Flex Part #	Flex Price* without monitor	Flex Price* with monitor
PS/ValuePoint Si - SpaceSaver									
486SX	25 MHz	120 MB/15 ms	3	2/1	512K	6.1	6381F30	Call	\$1249
486SX	25 MHz	212 MB/13 ms	3	2/1	512K	6.1	6381F50	Call	\$1349
486DX	33 MHz	120 MB/15 ms	3	2/1	512K	6.1	6381M30	Call	\$1679
PS/ValuePoint SpaceSaver (Includes 32-Bit VLB Slot, ZIFF socket, and is Pentium™ Overdrive Upgradeable)									
486SX	25 MHz	245 MB/15 ms	3	2/1	1 MB	5.2	6382F50	Call	\$1899
486DX	33 MHz	245 MB/15 ms	3	2/1	1 MB	5.2	6382M50	Call	\$1999
PS/ValuePoint Desktop (Includes 32-Bit VLB Slot, ZIFF socket, and is Pentium™ Overdrive Upgradeable)									
486SX	33 MHz	245 MB/15 ms	5	3/2	1 MB	5.2	6384K50	Call	\$1799
486SX	33 MHz	340 MB/14 ms	5	3/2	1 MB	5.2	6384K70	Call	\$1899
486DX	33 MHz	120 MB/15 ms	5	3/2	1 MB	5.2	6384M30	Call	\$1799
486DX	33 MHz	245 MB/14 ms	5	3/2	1 MB	5.2	6384M52	Call	\$1999
486DX	33 MHz	340 MB/14 ms	5	3/2	1 MB	6.1	6384N70	Call	\$1999
486DX2	66 MHz	245 MB/15 ms	5	3/2	1 MB	5.2	6384W50	Call	\$2299

* System prices include 14" FLEXVISION SVGA .28mm dot pitch, 1024x768 NI Monitor. Other ValuePoint models (including Mini-Tower) are available. Ask your Flex Sales Representative for details and prices.

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- 14" .39mm dot pitch, 1024x768: 6318... **\$299**
- 14" .28mm dot pitch, 1280x1024 NI Energy Star Compliant 6324... **\$449***
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340/680"/w+	*1929			
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Code # PM01A4

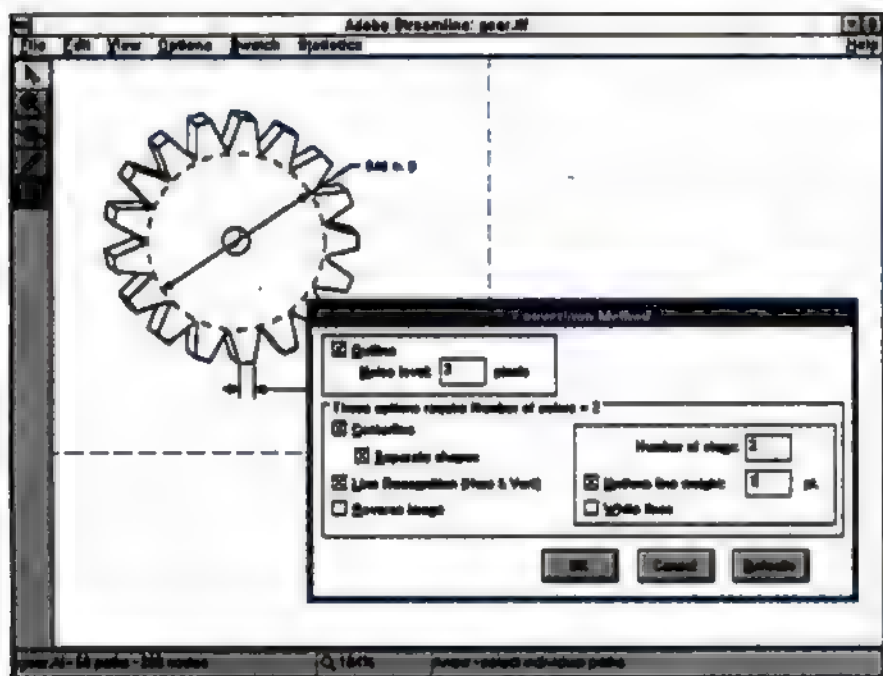


Figure 3: By combining and customizing Adobe Streamline's tracing options, you can improve the program's accuracy. Here, the selected options will result in a vector file that contains both closed objects (outline) and thin lines (centerline). In addition, groups of less than 3 pixels will be ignored as random noise. Note the ability to recognize lines that should be perfectly horizontal or vertical—in effect deskewing lines.

such as TIFF, and can export AutoCAD-compatible files, such as the AutoCAD DXF (Drawing Interchange Format). You can also produce IGES (Initial Graphics Exchange Standard) files with Canvas or PLT (Hewlett-Packard Graphics Language files) with Designer, CorelDRAW, or Streamline. These programs, however, are primarily targeted at the art market rather than the CAD market. So you may find that a visually accurate trace is not a functionally accurate trace. For example, a circle intersected by a line may be traced as a series of free-form curves rather than as two discrete geometric objects. At this point, your options are limited. You can edit the resulting traced image using either a vector illustration program or AutoCAD itself. Alternately, you can preprocess the raster file. For example, instead of trying to trace a single complex drawing, you may get better results by using a raster editor to delete extraneous elements first or to separate a complicated image into a series of simpler pictures.

Ultimately, you may be more productive if you purchase a CAD-specific autotracing utility that has been optimized for technical drawings. For example, a program such as Envision It, Version 2.0, from Envisions Solutions Technology (\$299, 800-365-7226), can trace circles and arcs as discrete objects rather than as a series of lines.

As usual, though, there are serious trade-offs associated with vertical market programs. Envision It exhibits many of the limitations of older DOS-based programs: It supports only expanded memory and forces you to keep the entire raster file in memory while performing its tracing operation. This means that the size of a drawing you can trace is limited by the amount of RAM in your system. In general, all of the CAD-oriented autotracing programs read only black-and-white raster files—no grayscale or color images are allowed. The reasoning is sound: Color is sacrificed in order to improve contrast and resolution. And of course, vertical market pro-

grams tend to be more expensive than their mass-market counterparts. So if you want high-end functionality, be prepared to pay high-end prices.

Two new high-end products for Windows will soon hit the market. RASation R2V, Version 1.0, from Image Systems Technology, is priced at \$1,995 (518-283-8783) and VPWindows, from Comnet, at \$2,500 (512-288-6120). Both of these programs can recognize circles, arcs, and polylines. In fact, if you configure the tracing parameters correctly, these programs can handle much more difficult tasks. For example, both programs can correctly interpret dashed lines (a common occurrence in technical drawings) as a single entity rather than as a series of short unconnected lines.

And while it may not be significant for scans produced on your ScanJet (which, like most desktop lasers, can handle only letter- and legal-size documents), both RASation R2V and VPWindows can process engineering-size scans, meaning C-size or larger. Most impressively, both programs can actually use line width differences to separate elements onto discrete layers within a drawing. Though there is no guarantee of a perfect tracing, both VPWindows and RASation R2V have the power to produce DXF documents that require very little editing.

Don't assume that this short list of products represents the universe of all

autotracing utilities. For a comprehensive list of raster-to-vector conversion programs that produce DXF files, get a copy of *The AutoCAD Resource Guide* (800-428-6179, fax 317-251-7813). This \$29.95 directory is available in either book or CD format and lists a wide range of products, all of which work with or enhance AutoCAD.—*Luisa Simone*

Networking

LINKING ETHERNET LANS

❓ We have four different Ethernet LANs in the same building, each separated from the other by several hundred feet. Some connect using thin coax and some comply with 10BaseT. No network serves more than a few users. We'd like to hook the LANs together in order to access the same e-mail and database files. What's the best way?

*William Vent
Detroit, Michigan*

► **PC MAGAZINE:** You need at least one multiport Ethernet repeater. Two companies, IMC Networks and Tut Systems, sell flexible and affordable (about \$200 per network span) devices that make it easy to intermix coax and 10BaseT. The IMC LANrepeater/8 uses a small cabinet to house individual connection modules for several different cabling schemes. You can configure the device with as many as eight BNC or 10BaseT connector modules. Contact IMC at 800-624-1070 or 714-724-1070.

Tut Systems offers a family of products called the MagicNet Multiport Thin Ethernet Repeaters that allow you to combine thin Ethernet and 10BaseT. The company also offers the NM 100 MagicNet Assistant Network Manager that unites a network traffic and diagnostic meter with a UTP-to-thin coax coupler. When everything is operating normally, the NM100's large meter shows network utilization. When things aren't right, the needle literally points out various conditions, such as open or short in the UTP, or a disconnected coax cable or terminator. Contact Tut Systems at 800-998-4888 or 510-682-6510.

—*Frank J. Derfler, Jr.*

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Full text of the last six months of Solutions is available for download in Windows Help format from ZiffNet. Look for the file SOL293.ZIP in the Utilities/Tips Forum, keyword "Solutions."



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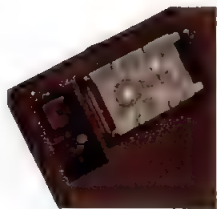
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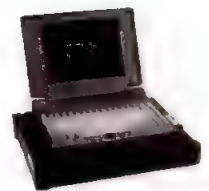
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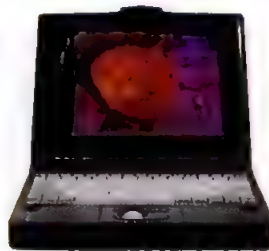


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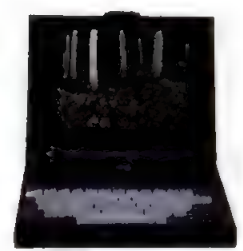
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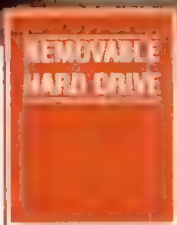
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Screen Size	14" FS Mono	14" Color	14" Color	14" Color	15" FS Color	17" FS Color
Max Refresh Rate	60 Hz	60 Hz	60Hz	72Hz	72Hz	72Hz
Dot Pitch	— N/A	.28mm	.28mm	.28mm	.28mm	.26mm
*Unit 1-25 Price	\$114	\$289	\$329	\$359	\$439	\$849
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Standard Features

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- Desktop Metal Cases
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- 4MB RAM
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- With 128k cache

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- All Standard Features+
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- 4MB RAM
- 14" .28 non-interlaced monitor
- With 128k cache

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- 424MB hard drive
- 8MB RAM
- 15" .28 non-interlaced monitor
- With 128k cache

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OPEN 7 DAYS - WEEK	YES	YES	YES		
EXPRESS PARTS SERVICE	YES	YES	YES		
PC TECHNICAL ADVICE	YES	YES	YES		
SYSTEM FEATURE	DEL.	WARRANTY	24HR	TECH SUPPORT	PC FAX
ANTI-VIRUS SOFTWARE	YES				
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Standard Features

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- Desktop Metal Cases
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- Remote Diagnostics Software
- 9600/2400 send/receive Fax/modem
- Anti-Virus Software
- Multi I/O - 2 Serial and 1 Parallel
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- 14" .28 non-interlaced monitor
- With 128k cache

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■ All Standard Features+

- Intel 486DX2/66
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- AD-lib, MPC compatible
- Sound blaster compatible
- Compton's Interactive Encyclopedia
- Webster's Dictionary
- World Atlas



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- 250MB hard drive
- 4MB RAM
- 14" .28 non-interlaced monitor

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- 4MB RAM
- 14" .28 non-interlaced monitor
- With 128k cache

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- All Standard Features+
- Intel 486DX2/50
- VLB accelerated graphics
- 424MB hard drive
- 4MB RAM
- 15" .28 non-interlaced monitor
- With 128k cache

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System 5

- All Standard Features+
- Intel 486DX2/66
- VLB accelerated graphics
- 424MB hard drive
- 8MB RAM
- 15" .28 non-interlaced monitor
- With 128k cache

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Popular Options

- 4, 8, or 16MB RAM
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- 17" .28 non-interlaced monitor
- Combo floppy drives

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Multi-Media systems can really turn your computer into a complete information resource for you and your family. Stereo sound and full motion video, interactive encyclopedia, educational software and games really come to life.

VTech has been building complete multi-media systems for years and we know what it takes to get all system components working together. Your VTech system will arrive completely setup and ready to run.

The VTech multi-media systems all feature double speed CD-ROM drives that double the data throughput and really enhances video and audio performance of today's multi-media software.

The VTech sound board provides a full 20-voices rather than the usual 11 or 16 voices the other manufacturers provide.

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VTECH[™] Platinum[™]

The VTech Platinum 486 SMP systems are the fulfillment of a long standing desire to build a desktop computer that alters the commonly accepted perceptions of a standard desktop computer.



Platinum Upgrade Options

Dual
Pentium Overdrive

Single
Pentium Overdrive

Dual
486DX2/66

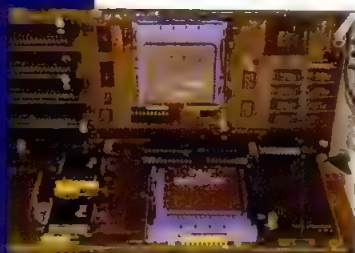
Single
486DX2/66

VTECH[™] Technology you can afford

The most advanced 486 system available

Advanced technology makes the difference.

The VTech Platinum 486 computers are the fastest, most powerful systems available. Imagine a system so fast it can keep up with Dual Symmetrical Multiprocessing Pentium[™] Overdrive processors and you'll understand why the VTech Platinum single processor 486 system outperforms all other systems on the market.



Each VTech Platinum 486 is designed with an exclusive copy back cache with cast-out buffering, high performance memory design, VESA Local Bus slots, two cooling fans, on board SCSI II, and self-sensing setup all managed by the industry's most advanced BIOS.

These are just a few of the advanced technology features that make the VTech Platinum computers the highest performing systems available.

The benefits are high performance, ease of use and more upgradability - your system will perform better, work harder and last longer.

The VTech difference

Because we control the complete design and manufacturing process, we can control the quality of our systems. VTech has been an OEM provider to some of the largest names in the business, companies that demand quality and depend on VTech.

We stand behind this commitment of quality with a 3 year warranty and the best customer support in the business. VTech is a name you can depend on.

Upgradability

As your needs change and new software pushes the limits of today's hardware, the VTech Platinum systems can be expanded to meet the challenge.

VTech provides you with three upgrade paths. From the single processor Platinum 486 you can upgrade to dual 486 processors, a single Pentium Overdrive[™] processor, or for the ultimate in power and performance, dual Pentium Overdrive[™] processors.

The VTech Platinum 486 is the only desktop computer that is Pentium OverDrive Ready and Symmetrical Multiprocessor ready. No more worrying about obsolescence - the VTech Platinum gives you the high performance you need today and the upgradability you'll need tomorrow.

Whether you start with the VTech Platinum 486 Single Processor or choose an SMP Dual Processor System, you're getting the most advanced computer system available.

The bottom line

The VTech Platinum 486 SMP delivers the performance you need for today's software and is unique in its ability to expand to meet the demands of tomorrow's high performance software and operating systems.

Compare these features anywhere and you'll see why the VTech Platinum has already received top recognition from industry experts.

The bottom line - the VTech Platinum is the best value in high performance computers.

"VTech delivers a fast multi-processor system at a single processor price." *Computer Shopper*,

VTech Platinum is SMP ready

The experts agree, your next system should be multiprocessor ready. As PC Week said on August 23, 1993, "Multiprocessing is clearly the wave of the future".

The VTech Platinum system features a unique, patented design that brings true Symmetrical Processing capabilities to the desktop. As PC Magazine said on October 12, 1993, "VTech leads in PC Multiprocessing".



With Microsoft Windows NT[™] the VTech Platinum SMP is an efficient way to double your power. Like a two lane highway that suddenly becomes four lanes, processing flows with greater ease and efficiency.



Whether you start with the VTech Platinum 486 Single Processor or choose an SMP Dual Processor System, you're getting the most advanced computer system available.



...Only from VTech

VTECHTM Platinum

486DX2/50 single

- Intel 486DX2/50 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 6MB System RAM
- 3.5" Floppy Drive
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15" 28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

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Options

- 17" 28 Monitor ■ CD ROM Upgrades ■ Increased RAM ■ High Speed 14.4 Modems ■ Combo Floppy Drives ■ Multi-Media kit

486DX2/66 single

- Intel 486DX2/66 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 12MB System RAM
- 3.5" Floppy Drive
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15" 28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

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486DX2/66 plus

- Intel 486DX2/66 Processor
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 16MB System RAM
- Double Speed CD-ROM
- 3.5" Floppy Drive
- 424MB Hard Drive
- 16550 Serial Port Controllers
- 15" 28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

\$2999

486DX2/66 dual

- 2 Intel 486DX2/66 Processors
- Pentium Overdrive™ ready
- SCSI II (on board)
- 256k Cache
- VESA Local Bus
- S3 Windows Accelerator Video Card w/1MB RAM
- 16MB System RAM
- Double Speed CD-ROM
- 3.5" Floppy Drive
- 527MB Hard Drive
- 16550 Serial Port Controllers
- 15" 28 Non-Interlaced Monitor
- MS DOS 6, Windows 3.1
- High Resolution Mouse

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The Expandable 486

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- Intel 486DX2/50 or 486DX2/66
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- MP Power Card with a second Intel 486DX2/50 or 486DX2/66 processor

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- Six (6) ISA Slots
- Two (2) VESA VL Slots
- One (1) MP Connector Slot

Ports

- Two (2) serial ports 16550-D89
- One (1) serial port ECP-D825
- PS/2 mouse port
- IDE port-floppy controller
- SCSI II connector on board
- Chassis**
- Height 6.5" Width 18.6" Depth 17.1"
- Supports three 5.25" or 3.5" external drive bays and one 3.5" internal hard disk drive

Advanced BIOS

- Supports multiprocessing start-up for advanced SMP capable operating system (Windows NT)
- Automatically detects and reports all processors installed and active
- Flexible memory configuration supports 288MB floppy drives
- Ability to autotype IDE hard disk
- Built-in Adaptec SCSI II support
- Two level password protection

Introducing Pentium. The newest addition to the Platinum series

Standard Features

- Intel 60MHz Pentium processor
- Next generation Pentium Overdrive processor P5T ready
- 256k cache
- 2 PCI expansion slots
- Window's accelerator with 1MB expandable to 2MB
- Dual cooling fans
- Advance BIOS with 2.88MB floppy drive support
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- Enhanced capabilities port
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- 3.5" floppy drive
- PCI SCSI II processor on board (optional)
- Self sensing set-up
- High performance-tactile keyboard
- MS-DOS 6.2, Windows 3.1

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- All Standard Features+
- 424MB hard drive
- 8MB RAM
- Double speed CD-ROM

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Popular Options

- 4MB, 8MB, 16MB or 32MB RAM
- 17" non-interlaced monitor
- Combo floppy drives

Platinum P5-60

- All Standard Features+
- 527MB hard drive
- 16MB RAM
- Double speed CD-ROM
- 17" non-interlaced monitor

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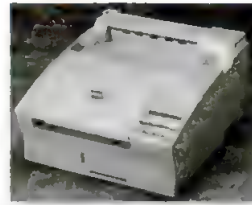
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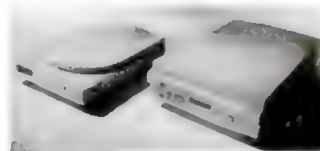
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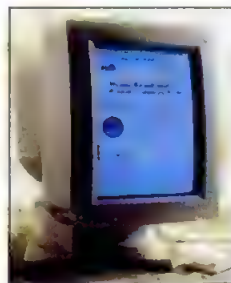
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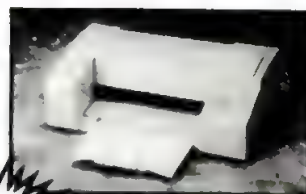
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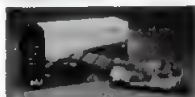
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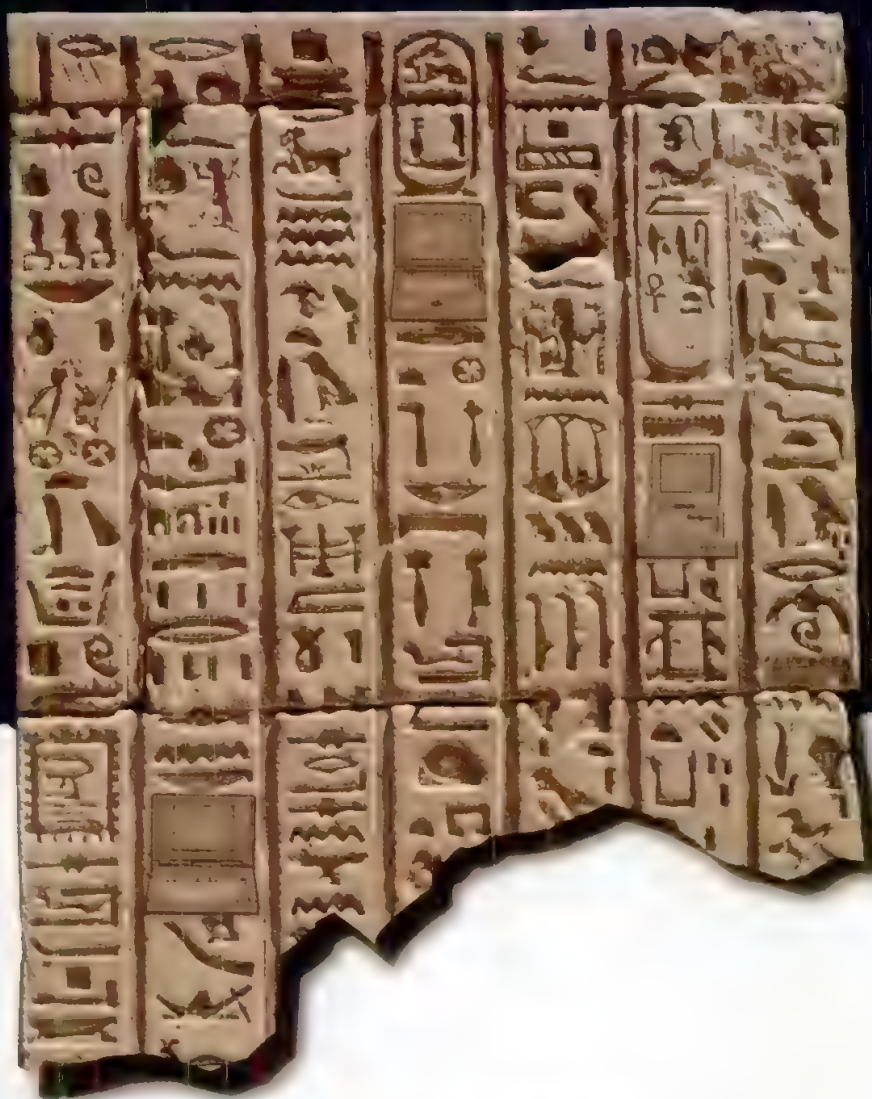
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- Dual Speed Multi-Session Multimedia CD-ROM Drive
- 3 Disk CD-ROM Software Library
- 16-Bit High-Performance Sound Card
- Digital-Quality, Compact Speakers
- 15" SVGA .28 Non-Interlaced Multi-Scan Color Monitor
- 32-Bit VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- Mini-Tower Case
- FREE Microsoft DOS 6.2 Installed
- FREE Microsoft Windows Installed

486DX2-50 \$1949

#006611

486DX2-66 \$2099

#006612

VESA CAD Systems

486DX-33 \$2199

#006613

Treasures:

- VESA Local Bus Motherboard
- Intel 80486DX-33 Processor
- 256K High-Speed Cache
- 8 Mb High-Speed RAM
- 32-Bit VESA Local Bus IDE Card
- 340 Mb IDE Hard Drive
- 1.44 Mb 3.5" Floppy Drive
- 1.2 Mb 5.25" Floppy Drive
- 17" SVGA .26 Non-Interlaced Multi-Scan Color Monitor
- Diamond Stealth 24 VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- Full-Tower Case
- FREE Microsoft DOS 6.2 Installed
- FREE Microsoft Windows Installed

486DX2-50 \$2279

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486DX2-66 \$2429

#006615

PCI Local Bus System

486DX2-66 \$2999

#006618

Elite's PCI Systems have a 32-bit data path and 33 MHz clock speed to produce maximum data transfer rates of 132 megabytes per second—a monumental improvement over standard ISA buses' 5 Mb/sec transfer rate! And since they are self-configuring, you should never have to touch switches or jumpers in Elite PCI Systems.

Treasures:

- PCI Local Bus Motherboard
- Intel 80486DX2-66 Processor
- 256K High-Speed Cache
- 8 Mb High-Speed RAM
- 32-Bit PCI Local Bus SCSI Interface
- 340 Mb SCSI Hard Drive
- 1.44 Mb 3.5" Floppy Drive
- 15" SVGA .28 Non-Interlaced Digital Color Monitor
- PCI Local Bus Accelerated

- SVGA Video Card
- Dual Speed Multimedia CD-ROM Drive
- 3 Disk CD-ROM Software Library
- 16-Bit High-Performance Sound Card
- Digital-Quality, Compact Speakers
- Internal 14.4 Modem
- 1 Parallel & 2 Serial Ports
- 101-Key Enhanced Keyboard

- High-Resolution, 3-Button Mouse
- Full-Tower Case
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486DX-33 \$2769

#006616

486DX2-50 \$2849

#006617

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AD#G0101

MidWest Micro

Elite 486SX/DX Notebook

SL-Enhanced Processor
Up to 340 Mb HD
PCMCIA Type III



A Dream Come True

Almost every ancient Egyptian dreamed of having a portable computer. Thanks to the 486SX/DX Notebooks, their dreams can come true for you.

These Elite Notebooks feature Intel's "SL-Enhanced" microprocessors, delivering excellent power management and a long battery life. The centerpiece of SL Technology is the System Management Mode (SMM), which allows your Notebook to slow down, suspend or completely shut down various components of your system.

The 486SX/DX Notebooks come with a divine gift—the gift of choice. Depending on your specific needs, choose from an 80, 120, 200

or 340 Mb hard drive, an upgradeable 486SX-25, 486DX-33, 486DX2-50 or 486DX2-66 processor and a large 10" monochrome, dual-scan color or active-matrix color screen.

Elite's 486SX/DX Notebooks also feature the latest PCMCIA technology. They all have a PCMCIA Type III slot, which accepts two Type I cards, two Type II cards or one Type III

card. Use these cards to add memory enhancements, network adapters, modems and more.

Buy the notebook ancient Egyptians only dreamed of—order your Elite 486SX/DX Notebook today.

120 Mb	486SX-25	486DX-33	486DX2-50	486DX2-66
Monochrome	#005501 \$1529	#005516 \$1769	#005531 \$1799	#005546 \$1959
Dual-Scan Color	#005506 \$1999	#005521 \$2399	#005536 \$2449	#005551 \$2599
Active-Matrix Color	#005511 \$2999	#005526 \$3299	#005541 \$3329	#005556 \$3499

For an 80 Mb hard drive subtract \$40, For a 200 Mb hard drive add \$100, For a 340 Mb hard drive add \$280

Treasures:

Processor:

Intel 486SX-25, 486DX-33,
486DX2-50 or 486DX2-66
SL-Enhanced upgradeable processor

RAM:

4 Mb, expands to 20 Mb

Hard Drive:

80 Mb, 120 Mb, 200 Mb or 340 Mb

Screen:

10", 640 x 480 VGA resolution
Backlit display
Color - 256 colors
Monochrome - 64 gray shades

Battery Life*:

Active Color - 3 hours
Dual-Scan Color - 4 hours
Monochrome - 6 hours

Weight:

Color - 6.9 lbs.
Monochrome - 6.4 lbs.
512K DRAM plus 64K VRAM for
turbo bus accelerated video technology
Simultaneous video on
active-matrix color and
monochrome units
86 keys with 101-key emulation
Built-in trackball

Built-in 1.44 Mb, 3.5" floppy drive

Advanced Power Management
One parallel and one serial port
External VGA and keyboard connectors
One PCMCIA Type III slot/ two
Type II slots
FREE AC adapter and utilities
disk
FREE MS-DOS 6.2 installed
FREE carrying case

Elite 486SX-25 SubNote

Ancient Egypt is known for great myths, historical treasures and powerful dynasties. You can discover another source of great power with Elite's 486SX-25 SubNote.

The 486SX-25 has the latest features, like Intel's "SL-Enhanced" processor, Advanced Power Management and PCMCIA technology.

It's a mystery how a little 3.9 lb. SubNote contains as much power as a desktop, but it does. The 486SX-25 comes with 4 Mb of RAM, expandable to 12 Mb, a fast 25 MHz processing speed and your choice of an 80, 120, 200 or 340 Mb hard drive. It also delivers excellent 640 x 480 VGA resolution on its 10" high-contrast screen producing clear, concise images that even a mummy can easily see!

Elite's unforgettable SubNote symbolizes power, ground-breaking technology and true portability. Before you hop on your camel to start your next historical journey—call MidWest Micro and order the 486SX-25.

Treasures:

Processor:
Intel 486SX SL-Enhanced
upgradeable processor

Processing Speed:
25 MHz

RAM:
4 Mb expands to 12 Mb

Hard Drive:
80 Mb, 120 Mb, 200 Mb
or 340 Mb

Screen:
10" 640 x 480 VGA resolution
Backlit display
64 gray shades

Battery Life*:
5 hours

Weight:
3.9 lbs.
**512K DRAM plus 64K VRAM for
turbo bus accelerated video technology**
Simultaneous video

83 keys with 101-key emulation
Built-in trackball
External 1.44 Mb, 3.5" floppy drive
Advanced Power Management
Nickel metal hydride battery
One parallel and one serial port
External VGA and keyboard connectors
One PCMCIA Type II slot
FREE AC adapter and utilities disk
FREE MS-DOS 6.2 installed
FREE carrying case



486SX-25 SubNote

80 Mb	#005575	\$1439
120 Mb	#005576	\$1479
200 Mb	#005577	\$1579
340 Mb	#005578	\$1759

Elite 486SLC-33 Color/Monochrome Notebook

Discover the riches of the land with your Elite 486SLC-33 Notebook. This portable is perfect for long journeys due to its compact size and energy-saving SUSPEND/RESUME feature. You can even compute up to six hours on a single charge!

Available in color or monochrome, the Elite comes with a fast 33 MHz processor, internal cache memory and up to 8 Mb of RAM—giving you more power for your money!

Both 486SLC-33 models have a record of unparalleled success in eliminating distortion and eyestrain with their non-glare VGA screens. Images appear at up to 640 x 480 resolutions in 64 gray shades or 256 colors revealing eye-catching text, graphics and hieroglyphics.

Your Elite's LCD panel lets you know which drives are being accessed, when battery power is low, what function keys are enabled, whether external power is being used and if there is a modem ring. All the information you desire is right before your eyes!

The wait is over for both you and the Pharaohs. Your Elite Notebook is here—and it's just a toll-free phone call away.

Treasures:

Processor:
Cyrix 486SLC-33
Processing Speed:
33 MHz

RAM:
2 Mb RAM, expands to 8 Mb

Hard Drive:
80 Mb, 120 Mb or 200 Mb

Floppy Drive:
Built-in 1.44 Mb 3.5"

Screen:
Color - 9", 256 colors
Monochrome - 10",
64 gray shades

Video RAM:
Color - 512K
Monochrome - 256K

Keyboard:
83 key with 101-key emulation
2-button thumbball mouse

Weight:
Color - 5.7 lbs. with battery
Monochrome - 5.4 lbs.
with battery

Battery Life*:
Color - 4 hours
Monochrome - 6 hours

640 x 480 resolution
Simultaneous video
Advanced Power Management
One parallel and one serial interface
**External VGA monitor and key-
board connectors**
**FREE AC adapter, carrying case and
MS-DOS 6.2 installed**
One year manufacturer's warranty



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Customer Service & Technical Support Call:

1-800-243-0313

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	80 Mb	120 Mb	200 Mb
Color	#005461 \$1599	#005466 \$1659	#005471 \$1759
Monochrome	#005446 \$1199	#005451 \$1239	#005456 \$1339

*Battery life measured with Power Management enabled. Actual battery life may vary.

AD#G0103

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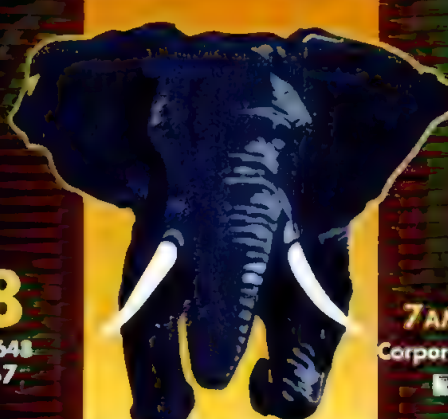
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ZENITH DATA SYSTEMS
A Bull Company

Z-STAR 433VL Notebook

- 486SLC/33 processor
- 4MB RAM, expandable to 12MB
- 9.5" screen
- PCMCIA Type II slot
- MS-DOS 6.0, Windows 3.1.
- MS-Works for Windows

Screen	Hard drive	Price
Monochrome	170MB	\$1629*
Dual scan color	200MB	\$2299

Lease for \$59.78/mo.

\$1629




Bravo Notebook

- 486SX/25 processor
- Accelerated local bus graphics
- PCMCIA Type III slot
- MS-DOS 6.0, Windows 3.1

Screen	Model	Hard drive	Price
Monochrome	83W	80MB	\$1599*
Monochrome	123W	120MB	\$1799
Monochrome	123W	170MB	\$1899
Dual scan color	123W	120MB	\$2449
Dual scan color	173W	170MB	\$2559
Active matrix	173W	170MB	\$3349

Lease for \$62.35

\$1699



COMPAQ

Contura

- 486SL/25 processor
- 4MB RAM
- Trackball, MS-DOS, Windows
- 3-year warranty

Display	Hard drive	Price
Monochrome	209MB	\$2199*
Dual scan color	120MB	\$2699
Dual scan color	209MB	\$2879

Lease for \$80.70/mo.

\$2199




TEXAS INSTRUMENTS

TravelMate 4000 Color

- 486 processor
- 640x480 VGA display, 256 colors
- Local bus video**
- MS-BallPoint/Quickport connector
- MS-DOS, Windows 3.1

Processor	RAM	Display	Price
486SX/25	4MB	Enhanced color	\$2199*
486DX2/40	8MB	Passive	\$2999
486DX2/50	4MB	Active	\$3849

**except DX2/40

Lease for \$80.70/mo.

\$2199




PowerExec

- 4MB RAM, expandable to 20MB
- Windows 3.1
- Trackball

Processor	Model	Price
486SL25 Monochrome	203W	\$2399*
486SL25 Active Color	203W	\$4029
486SL33 Active Color	203W	\$4229
486SL33 Active Color	343W	\$4629

Lease for \$73.36/mo.

\$2399



NEC

UltraLite Versa E

- 486 processor
- 4MB RAM, expandable to 20MB
- 2 PCMCIA slots
- Local bus graphics
- MS-DOS 6.0, Windows 3.1, built-in trackball

Processor	Screen	Hard drive	Price
DX2/40	Active color	120MB	\$3819
DX2/40	Active color	250MB	\$4229
DX2/50	Monochrome	209MB	\$3259
DX2/50	Monochrome	340MB	\$3669
DX2/50	Active color	209MB	\$4499
DX2/50	Active color	340MB	\$4919

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- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ Type III PCMCIA slot
- ▲ 82 key keyboard
- ▲ BallPoint mouse with QuickPort
- ▲ MS-DOS 6.0, Windows 3.1

Model	Screen	Hard drive	Price
T1900 486SX20	Monochrome	120MB	\$1499*
T1900 486SX20	Monochrome	200MB	\$1729
T1900 486SX20	Dual Scan Color	120MB	\$2099
T1900 486SX20	Dual Scan Color	200MB	\$2329
T1950 486DX2/40	Monochrome	120MB	\$1899
T1950 486DX2/40	Monochrome	200MB	\$2099
T1950 486DX2/40	Dual Scan Color	120MB	\$2499
T1950 486DX2/40	Dual Scan Color	200MB	\$2719
T1950 486DX2/40	Active Color	120MB	\$2899
T1950 486DX2/40	Active Color	200MB	\$3069
T1950 486DX2/40	Active Color	320MB	\$3399

*Lease for 55.01/mo.



T4600

Exceptional performance

- ▲ 33MHz 486SL processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 9.5" display
- ▲ 2 PCMCIA slots:
16mm Type IV & 5mm Type II
- ▲ 82 key keyboard
- ▲ BallPoint mouse with QuickPort
- ▲ MS-DOS 6.0, Windows 3.1

Screen	Hard drive	Price
Monochrome	120MB	\$2399*
Monochrome	200MB	\$2589
Active Matrix Color	120MB	\$3889
Active Matrix Color	200MB	\$4099
Active Matrix Color	340MB	\$4449

*Lease for 88.04/mo.



T6600

Fully Equipped Multimedia Computer

- ▲ 486DX2/66 processor
- ▲ 8MB RAM, expandable to 40MB
- ▲ 10.4" active matrix color display
- ▲ 16mm PCMCIA slot
- ▲ 2 full length 16-bit ISA slots
- ▲ Detachable 101 key keyboard
- ▲ 2 built-in stereo speakers
- ▲ Microsoft Sound System
- ▲ MS-DOS 6.0, Windows 3.1, Asymetrix COMPEL and MediaBlitz!

Model	Description	Price
T6600C	Base model	\$6289*
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*Lease for 230.80/mo.



Dual Scan Color Technology

Older generation passive displays have a 1/480 duty ratio which means that power is driven all the way from the top of the screen to the bottom of the screen. The T1900C's new dual scan color display has a 1/240 duty ratio. Imagine the screen split in two horizontally and now power is driven from the top and bottom of the screen. Since the T1900C receives power at twice the rate of older passive displays, the T1900C is brighter and faster.

AST, Compaq, NEC, Texas Instruments, Toshiba



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- 486 processor
- 4MB RAM expandable to 32MB
- VESA Local bus graphics
- 3.5" and 5.25" floppy drives
- MS-DOS 6.0, Windows 3.1, Works, MS-Money, Entertainment Pack 4, MS-Productivity

Processor	Hard Drive	Price
486SX/25	170MB	\$969*
486SX/33	170MB	\$1059
486DX/33	260MB	\$1259
486DX2/66	345MB	\$1789

Color VGA monitors start at \$229.99

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\$969



COMPAQ

Prolinea Desktops

- 4MB RAM expandable to 32MB
- 3.5" floppy drive
- Local Bus graphics
- MS-DOS 6.0, Windows 3.1, Mouse

Model	Hard drive	Price
486SX25	120MB	\$999*
486SX25	240MB	\$1089
486DX33	120MB	\$1389
486DX33	240MB	\$1469
486DX2/66	340MB	\$1979

Bundles also available

COMPAQ SVGA color monitor \$349.99

Lease for \$50/mo.

\$999



AST

Authorized Systems Provider

Bravo Desktops

- 4MB expandable to 64MB
- 120MB or 210MB hard drive
- Local bus video 1024x768
- OverDrive and P24T upgradable

Model	123/W	213/W	Price
4/25e	120MB	—	\$ 999**
4/33	120MB	—	\$1299
4/33	—	210MB	\$1539
4/66d	—	210MB	\$2099

AST SVGA color monitor \$379.99

**Limited Time Only

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AST

Authorized Systems Provider

Bravo LP

- "Green" PC
- 486 processor
- Accelerated local bus graphics
- Local Motion video capability
- Pentium/Overdrive upgradable
- MS-DOS 6.0, Windows 3.1, Mouse

Model	RAM	Hard drive	Price
4/25e	4MB	170MB	\$1179*
4/33	4MB	170MB	\$1449
4/33	8MB	340MB	\$1899
4/66d	8MB	340MB	\$2449

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- 9600/4800 fax, 2400 data modem

Processor	Hard drive	Price
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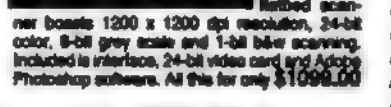
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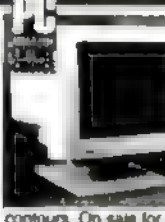
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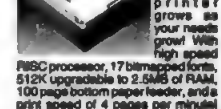
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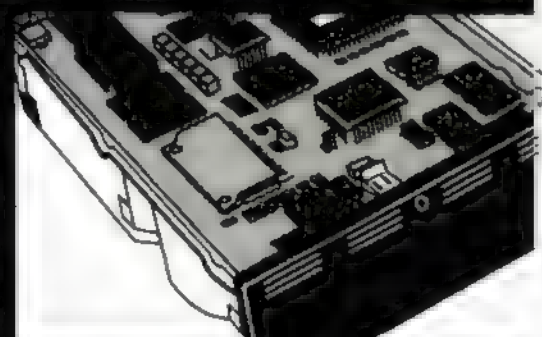
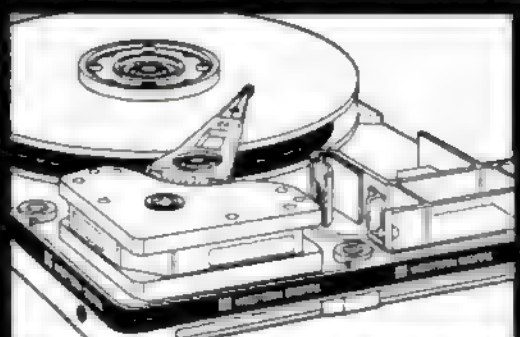
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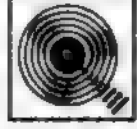
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GSI GSI drive accelerators increase the data transfer rate of your IDE drive 30 to 80%. Works by enabling the drives Read Multiple & Write Multiple commands to greatly increase performance. We highly recommend these products for Conner, Quantum, Seagate, Micropolis, Maxtor, & Fujitsu. Alone w/Drive

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GSI-32 Board same as -21 adds 2 16550 serial ports & 1 bi-directional parallel port	\$139	\$119
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CONNER

IDE	170MB	13ms	CFA170A	\$189
	250MB	14ms	CP30254H	\$235
	340MB	13ms	CFA340A	\$299
	540MB	10ms	CP30544	\$569
SCSI	540MB	10ms	CP30540	\$579
	1060MB	9ms	CFP1060S	\$939

digital

SCSI	1070MB	9.5ms	DSP3107	\$949
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	2103MB	9.7ms	DSP3210	\$1559
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HARD DRIVES

Quantum

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	342MB	12ms	LPS340A	\$359
	541MB	12ms	LPS540A	\$555
SCSI	170MB	14ms	LPS170S	\$189
	270MB	12ms	LPS270S	\$259
	342MB	12ms	LPS340S	\$359
	541MB	12ms	LPS540S	\$585
	1080MB	10ms	IMP1080	\$879
	1225MB	10ms	PD1225S	\$969
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Seagate

IDE	213MB	16ms	ST3243A	\$199
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	341MB	12ms	ST3390A	\$319
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A1542KIT 16Bit SCSI	\$275	\$259
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A2842 VESA SCSI	\$319	\$299
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Sony	CDU 561	295ms	\$559
Sony	31A-03	325ms	\$399
Teac	CD-50	265ms	\$539

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Toshiba	XM3401	200ms	\$365
Sony	CDU561	295ms	\$329
Teac	CD-50	265ms	\$329

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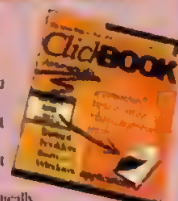
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1MB w/VPB				PS/2 35SX, 35, 40SX, 55SX, 15, 45SX, 15, Xsistent, PS/1 Valuepoint Cxx series, adapter board 34F3011 or 34F3012			
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4MB w/VPB				PS/2 35SX, 35, 40SX, PS/1 Valuepoint Cxx series			
500718-004, 780-005				6MB 6450429	5418		
Premium 384/33T, 386SX/16, Premium II 386SX/20, 25				PS/2 70/20, 95 XT, P75 (open), 56, 57 (all), PS/1 Pro M2123			
4MB w/VPB				2MB 6450402	597		
500780-004	5177			PS/2 70/20, 95 XT, P75 (open), 56, 57 (all), PS/1 Consultant, Essential, Expert models w/1, x13, x14, PS/1 Pro M2123, IS/6000 POWERstation/POWERserver 220 series			
Advantage 486/25, 33, 33c, SX/20, Bravo 4/33, 486/25, 25T, 33, 33c, 33T, Premium II 384/25, 33, 486/33, 486SX/20				4MB 6450128	5195	8MB 6450130	\$410
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Performance MC series				2MB			
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16MB 310-3336	5649	32MB 310-3337	\$1299	N/A			
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Hewlett-Packard				Zenith			
Vectra GS/165, 700P, 700C, 700Z, 700, 25c, 25c				2-300/400 Series Plus, Z-430/SX, Z-435/SX, Z-433/UX, Z-433/SX			
4MB Kit				4MB ME-100	5195		
Vectra 384/148, 384/208, 384/258 PC				16MB ME-100	5649		
2MB D2406A	5109	8MB D2404A	\$242	4MB ME-432	5194		
Vectra 484PC, 25T, 33T, 486/20, 484/25X, 33c, 50c, 64M				8MB ME-102	5376		
2MB D2781A	597	8MB D2152A	\$410	16MB ME-442	5749		
4MB D2154A/S1A	5195	16MB D2676A	\$649	32MB ME-92	5191		
Vectra 384/25, 484/25U, 484/25U, 484/50U, 484/64U				Z-Station 3250, 325S, 430SX, 51c, 425SX, 4330UX, 4330UX, 4500UX			
2MB D2381A	597	8MB D2152A	\$410	1MB ME-70	558		
Vectra 484/25X, 484/33X, 484/50X, 484/64M				4MB ME-100	5195		
16MB D2876A	5649			Z-384/20, 25, 33, 33c			
Vectra 384/33X, 33M				1MB Z43000H	550		
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LTi Line 20, 25, 25c, 25c	4MB		\$158
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LTi Line 4/25c	4MB		\$211
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AMBRA Trucon	2MB		\$112
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ThinkPad 710T	2MB		\$180
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NS1 Notebook (40)	2MB		\$182
	4MB		\$180
LAQ5X, H35SL, PS/Note 182	4MB		\$195
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45. A Ring of 11 Modules 527

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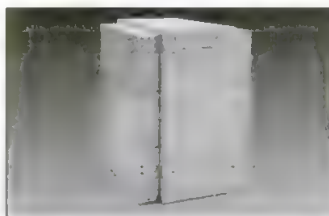
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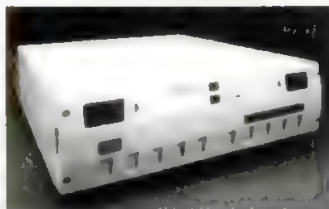
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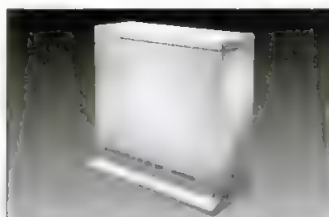
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ST3390M	341	1"	12	CALL
ST3550M	456	1"	12	CALL
ST3600M	525	1"	11	CALL
ST4767M	665	FH	12	CALL
ST41200M	1037	FH	15	CALL
ST31200M*	1050	1"	9	CALL
ST11200M*	1050	3.5	11	CALL
ST41600M	1370	FH	12	CALL
ST41650M	1415	FH	15	CALL
ST11900M*	1700	3.5	9	CALL
ST11950M*	1700	3.5	8	CALL
ST42100M*	1900	FH	13	CALL
ST12550M*	2145	3.5	8	CALL
ST12400M*	2100	3.5	9	CALL
ST42400M*	2106	FH	10	CALL
ST43400M*	2912	FH	10	CALL
IDE				
ST3144A	130	1"	16	CALL
ST3243A	212	1"	16	CALL
ST3283A	245	1"	12	CALL
ST3290A**	260	1"	16	CALL
ST3290A**	341	1"	12	CALL
ST3550A	452	1"	12	CALL
ST3655A**	545	1"	12	CALL

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TYPE	MB	SIZE	SEEK	PRICE
SCSI				
7245S	245	1"	15	\$ 221
7345S	340	1"	15	\$ 323
LXT540S	540	3.5	8.5	\$ 583
IDE				
7131A	130	1"	15	\$ 168
7213A	213	1"	15	\$ 196
7245A	245	1"	15	\$ 223
7345A	340	1"	14	\$ 277
540A	540	3.5	8.5	\$ 572

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TYPE	MB	SIZE	SEEK	PRICE
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LP5240S-A	240	1"	16	\$ 229
LP5255S-A	525	1"	10	\$ 552
PD1050S	1050	3.5	10	\$ 847
PD1225S	1225	3.5	10	\$ 957
PD1800	1800	3.5	10	\$ 1163

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TYPE	MB	SIZE	SEEK	PRICE
IDE				
WD1210	200	1"	14	\$ 199
WD2250	245	1"	14	\$ 223
WD2340	340	1"	13	\$ 270
WD2420	420	1"	13	\$ 345

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2217	1750	3.5	10	\$ 1102
1926	2100	FH	11.5	\$ 1413
1936	3050	FH	12	\$ 2028
IDE				
2205A	560	3.5	10	CALL
2210A	1035	3.5	10	\$ 831
2217A	1750	3.5	10	\$ 1102
AUDIO VIDEO				
2210AV	1050	3.5	10	\$ 887
2217AV	1750	3.5	10	\$ 1158

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M2694	1080	3.5	10	\$ 865
M2654S	2061	FH	11	\$ 1370
IDE				
M2624T	520	3.5	12	\$ 548

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DSP3105	1050	3.5	9.5	\$ 891
DSP3160	1660	3.5	10	\$ 1127
DSP5200	2000	FH	12.5	\$ 1158
DSP3210	2100	3.5	10	\$ 1576
DSP5350	3500	FH	11.5	\$ 2247
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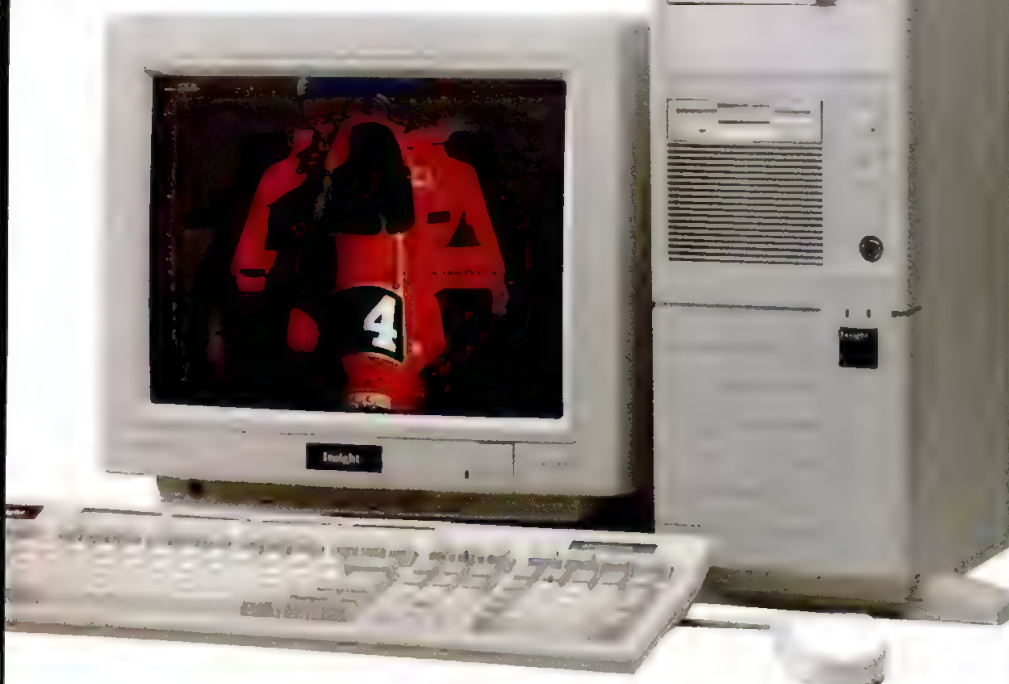


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256KB x 9 70ns	Call
4MB x 9 70ns	Call
512 x 36 2MB	Call
1 x 36 4MB	Call
2 x 36 8MB	Call
4 x 36 16MB	Call

PCMCIA CARDS

Megahertz

3400000 bps. MBX1214	\$250
14 414.4 bps. MBX1144	420
Intel FaxModem 2400/9600 bps.	270
Intel FaxModem 9600/9600 bps.	370
Intel FaxModem 14 414.4 bps.	450
Xircom Network combo	290
Xircom Network Fx-45	290
Xircom Network BNC	290
US Robotics FaxModem 14 414.4 bps.	440
US Robotics FaxModem 2400/9600 bps.	300
Talon Network 10BT NYTA10BT	360
Talon Network 10BT NYTA10BT	280

INPUT DEVICES

Digital Ergonomic Mouse	\$45
Logitech Mouse Man. serial	70
Logitech Mouse Man. bus	95
Logitech TrackMan Portable	280
Logitech ScanMan 256	310
Logitech ScanMan 256 w/ Catwhisker	310
Logitech Foto Man	540
Kurita XLP 12"x12" Digitizer	330

MATH COPROCESSORS

intel

80287XL	\$90
80387BL/3X	90
80387 (DX)	90

INTEL OVERDRIVE

intel

OverDrive 486SX20	\$320
OverDrive 486SX25	430
OverDrive 486SX25	430
OverDrive 486SX33	570

PRINTERS

Canon

BJ-10EX CIBJ10EXW	\$249
BJ-200 Bubble Jet CIBJ200W	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290
BJ-200 CIBJ200	290

CITIZEN Printers

GSX-240 CITOXS240	\$294
GSX-240 Color Option CITOCL040	40
Wire Carriage CITOXC140	360
Color Inkjet CITOCL040	360

Epson

Epson Art3250	\$174
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160
Epson LX-810	160

FUJITSU

Print Partner 10 FJPP10	\$1,290
Print Partner 10W FJPP10W	1,390

HP Printers

HP DeskJet 310 MHPD310	\$299
HP DeskJet w/Clut Sheet Feeder	350
HP DeskJet Color Kit	30
HP DeskJet Accessories	Call

IBM by Lexmark

2380 MALEX2380	\$310
2381 MALEX2381	440
2382 MALEX2382	440
2383 MALEX2383	440
4020020 Laser 6 MALEX4020	960
4020020 Laser 10 MALEX4020	1,120
4027 SE Laser	650

NEC

P3600 24 Pin NCMDL3600	\$220
P3600 24 Pin NCMDL3600	400
StarterKit 1067 NCMDL1067	1,420

OKIDATA

OK400E Laser	\$500
OK410 Laser	520
OK450 Laser	1,230
ML380 Dot Matrix	210
ML450 Dot Matrix	410
ML184 Dot Matrix	220
ML320 Dot Matrix	290
ML321 Dot Matrix	410
ML395 Dot Matrix	990
ML395C Dot Matrix	1,010
ML320 Dot Matrix	410
ML321 Dot Matrix	480
ML381 Dot Matrix	567
OK 630+ Dot Matrix	1,070

Panasonic

KX-P4410 Laser	\$680
KX-P4430 Laser	680
KX-P4450 Laser	1,140
KX-P4450 Laser	940
KX-P2023 Dot Matrix	105
KX-P2123 Dot Matrix	235
KX-P2124 Dot Matrix	315
KX-P2624 Dot Matrix	360
KX-P2123 Dot Matrix	290
KX-P3124 Dot Matrix	340
KX-P3024 Dot Matrix	400

star

NX-2430 24 Pin	\$235
SJ-144 Thermal Jet	470
LS-5EX Laser	607

TEXAS INSTRUMENTS

T1 MicroWriter LED 5ppm 512K	\$490
T1 MicroWriter P523 LED 5ppm 2MB	670
T1 MicroWriter P523 LED 5ppm 2MB	920
T1 MicroWriter 5ppm 512K RAM	690
T1 MicroWriter P517 5ppm 1.5MB	785
T1 MicroWriter P535 5ppm 1.5MB	810
T1 MicroWriter P535 Turbo 5ppm 2MB	1,080
T1 MicroWriter Pro P523	1,340
T1 MicroWriter Pro P535	1,520

MODEMS

intel

Intel Internal 14.4 modem	\$190
Intel SetFax100	90
Intel SetFax200	225
Intel SetFax300	245
Intel SetFax400	360
Intel SetFax500	260
Intel SetFax600	320

Hayes

Hayes Ultra 96 Modem	\$580
Hayes Ultra 144 Modem	680
Hayes Optima 24+ Fax 96	150
Hayes Optima 9600 EZ	340
Hayes Optima 144/3C EZ	430

PRACTICAL PERIPHERALS

PractiCARD PCMCIA	\$410
PM14400FX TAT Ext V 32bps	230
PM14400FX PKT Pocket V 42bps	Call
PM14400FX Internal V 42bps	210
PM14400FX External V 42bps	210
PM14400FX Internal V 42bps	210
PM14400FX External V 42bps	210
PM14400FX Internal V 42bps	210
PM14400FX External V 42bps	210
PM14400FX Internal V 42bps	210
PM14400FX External V 42bps	210

CD-ROM DRIVES

CHINON

Model CDD635	
Base	\$390
Kit	\$420

NEC

Model 84	
Base	\$390
Kit	\$470

Talon

Talon DS-100 320mb/200KB	\$340
Talon DS-200 245mb/330KB	390

TEAC

Base	\$330
Kit	\$400

PLEXTOR

Internal Base 3020	\$330
Kit	\$420
External Base 450 w/controll	540

TOSHIBA

Model 3401	
Base	\$420
Kit	\$490

MULTIMEDIA

CREATIVE

Sound Blaster Pro Deluxe	\$125
Discovery CD 8 Internal Kit	380
Discovery CD 16 Internal Kit	465
Edutainment CD 16 Internal Kit	530
Sound Blaster 16 ASP	290
Sound Blaster MDI Kit	58
Video Blaster	340
Video Spigot for Windows	460

MEDIA VISION

Fusion Double CD 16 System	\$630
Pro AudioSpectrum 16 SoundCard	160

REVEAL

MultimediaFX - 02	\$380
MultimediaFX - 04	490
MultimediaFX - 08	540

Talon

TA-2000DS Multimedia kit	\$590
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Introducing the Connection 14.4 + Fax, a pioneer in digital signal processing (D.S.P.) D.S.P.-based modems allow the functions of hardware to be transferred software. You can now upgrade your modem features without changing your hardware! Keep up with new standards, get more out of your modem and save money by simply installing new software.

Connection 14.4/14.4 data/fax modem ships with WinFax Lite, Qmodem and Prodigy, is made in the USA and features a five-year warranty from Digidom Systems. The Connection series meets all CCITT standards and offers upgrades such as 19,200bps and voice messaging.



Connection 14.4 + Fax MBG14F...\$139

Connection 14.4 data only modem MBG14G/14.4 \$129

MONITORS

HITACHI

19" SuperScan CM1085	\$490
17" SuperScan CM1707	580
20" SuperScan 20x CM2085M	1,340
20" SuperScan Pro CM2087	1,640
21" SuperScan Pro CM2187-5	2,090
21" SuperScan Elite CM2188	2,490

NEC

15" 1024x768, 16, 28 dp, MRP II	\$390
15" 1280x1024, 16, 28 dp, MRP II	590
15" 1280x1024, 16, 28 dp, MRP II	1,290
15" MultiSync 3F06 CMNECF06	740
17" MultiSync 3F06 CMNECF06	1,060
21" MultiSync 6F06 CMNECF06	2,390

TAPE BACKUPS

COLORADO

250MB COLUMBO	\$180
120MB COLUMBO	90
Trailer 250MB COUT20	320
Trailer 120MB COUT10	290

CONNER

TapeStor 250MB Internal A250	\$130
TapeStor 250MB Ext. Pir A250EP	250

EXABYTE

8mm 5.0Gig Model 8000	\$2,590
8mm 2.2Gig Model 8200	1,890
8mm Tape Cartridge	16.95

OMEGA

Imageta Tape250 In/Ext Internal	\$180
Imageta Tape250 In/Ext Half-height	180
Imageta Tape250 PC Powered Ext	310

Talon

250MB Internal	
w/2 formatted tapes T8TA250IK	\$170
w/5 formatted tapes T8TA250IK5	220

WangDAT

4mm DAT 20B Int. 16 Bit Kit	\$990
4mm DAT 4GB 3200 Int. 16 Bit Kit	1,190
4mm DAT 4GB 3200 Ext. 16 Bit Kit	1,290

HARD DRIVES 40MB to 2.0 GB!

HARD DRIVES

International

Complete installation kit, including: 5 1/4" mounting frame, Data Cable Rail Set, Screws, Jumper Blocks & Bezzels 10's Hard Drive Installation Guide with step-by-step installation instructions

Size	Access	Form Factor	Manufacturer	Interface	Model#	Base Kit	16 Bit Kit
42MB	28mm	3.5" 17H	Seagate	IDE	ST315A	\$139	159
130MB	15mm	3.5" 17H	Seagate	IDE	ST314AA	169	189
250MB	12mm	3.5" 17H	Western Digital	IDE	WD2250A	219	239
250MB	12mm	3.5" 17H	Conner	IDE	CP1025A	229	249
340MB	12mm	3.5" 17H	Western Digital	IDE	WD2340A	279	299
345MB	15mm	3.5" 17H	Mindor	IDE/SCSI	M07345A/S	299/149	349/149
452MB	12mm	3.5" 17H	Seagate	IDE/SCSI	ST3550A/N	409/539	439/569
520MB	12mm	3.5" HH	Fujitsu	IDE/SCSI	FJ262A/S	569	619/749
540MB	12mm	3.5" HH	Seagate	IDE/SCSI	ST3655A/N	579/999	599/974
1050MB	15mm	3.5" FH	Seagate	SCSI	ST12300N	899	1,049
1050MB	10mm	3.5" HH	Microsil	SCSI	MC2112A/S	839	859/999
1749MB	14mm	5.25" FH	Microsil	SCSI	MC158	1,029	1,119
1900MB	13mm	5.25" FH	Seagate	SCSI	ST42100N	1,479	1,629
2100MB	11mm	5.25" FH	Microsil	SCSI	MC1926	1,949	2,209
2900MB	12mm	5.25" FH	Seagate	SCSI	ST43400N	2,099	2,249

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CACHE MEMORY

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8Kx8		6.50	8.00	5.50
32Kx8	28.00	9.00	8.00	7.00
64Kx8	-	12.00	9.00	8.00
64Kx4	-	11.00	8.00	8.00
16Kx4	-	8.00	7.00	6.00
128Kx8	-	-	49.00	36.00

Individual D-RAM Chips

MEMORY FOR IBM & APPLE	8087	8087-2	8087-1	8087-XL	80387-16 DX	80387-20 DX	80387-DX (Does All)	80487-DX (Does All)	Intel SX (Does All)	Intel SL Mobil	Intel 16SX	Intel 20SX
1Megx1	7.35	7.25	8.75	4.95								
1Megx4	35.00	29.00	27.00	-								
1Megx4 (Zip Pack)	25.00	23.00	21.00	-								
256 x 4	-	-	11.95	10.95								
(Video Zip)	-	-	-	-								
256x4	4.75	4.50	-	-								
256 x1	3.00	2.75	2.50	2.25								
256 x16VRAM	-	39.00	39.00	-								
64x4	-	-	3.25	-								
64x1	-	-	-	2.00								

INTEL Math Chips

Change Your 386 to a 486DLC

Plug Composites • Cache Buffers • Ultra 387 Math Chip	Landmark V 2.8
Cyrix 486 DLC 40MHz	199.00
1Megx4 33MHz	173.00
25MHz	118.00
Cyrix 486 SLC 33MHz	159.00
25MHz	128.00
Cyrix 486 DRx	Call

CYRIX DRx 386 to 486 Upgrade

Clock Doubler

Single chip upgrade solution	CX486 DRx-16/32	269.00
Clock doubling tech		
Compatible with industry standard 386/486 CPU socket	for 386DX-16mhz	
Compatible with DOS, Windows, 3.1, OS/2 1.3 and 2.x	CS486DRx-20/40	319.00
Uses industry standard math chip	for 386DX-20mhz	
Easy to install—about 15 minutes	CX486 DRx-25/50	359.00
	for 386DX-25 mhz	
	DRx 33/66	PLEASE CALL
	for SX-25 upgrade	

1Meg x 9 (3 chip)	40MB	33MB	20MB	16MB	10MB
1Meg x 9 (3 chip)	65.00	65.00	52.00	50.00	49.00
4Meg x 9	65.00	65.00	59.00	57.00	54.00
16Meg x 9 (3 chip)	-	-	165.00	159.00	149.00
16Meg x 9 (3 chip)	-	-	879.00	849.00	-
16Meg x 9 (3 chip)	-	-	-	899.00	-

72 PIN SIMMS (EISA)

256 x 36 1Meg	512 x 36 2Meg	1 x 36 4Meg	2 x 36 8Meg (w/pal)	2 x 36 8Meg (w/o pal)	4 x 36 16Meg	8 x 36 32Meg	16 x 36 64Meg
-	-	-	-	-	-	-	-
-	-	-	224.00	209.00	199.00	-	-
-	-	-	399.00	444.00	449.00	-	-
-	-	-	424.00	444.00	449.00	-	-
-	-	-	749.00	749.00	769.00	-	-
-	-	-	-	1699.00	1769.00	-	-
-	-	-	-	-	3899.00	-	-

CYRIX FASMATH PROCESSOR

Programs executed up to 3X faster • Plug & object code compat w/Intel	83087-40MHz - \$9.00	83087-33MHz - \$9.00	83587-25SX Ver - \$9.00	83587-33SX - \$9.00
				PC Week™ rated #1 over all math chips
				5 Year Warranty • "All Downward Compatible"

AST MEMORY MODULES

MODEL	AMT. UPGRADED	AST PART #	PRICE
Advantage 12-386	4Meg Kit	500510-004	228.00
Bravo 486	4Meg	500587-002	199.00
	8Meg Kit	500587-003	398.00
	16Meg	500587-004	658.00
Premium 386/25, 16 SX	1Meg	500718-001	59.00
Premium 386/33	1Meg	500718-002	59.00
Premium II	1Meg	500780-003	WPB 59.00
386SX20, 486-25, 25E, 33	4Meg	500780-004	WPB 199.00
Premium Tower, 386/33TE, 486/25TE, 486/33TE	8Meg	500780-001	WPB 398.00
Cupid Memory Board	0-32Meg	500818-001	169.00

ZENITH MEMORY MODULES

MODEL	AMT. UPGRADED	AST PART #	PRICE
Z386/33, 25, 20, 33E	1Meg	ZA3800ME	59.00
Z386/33, 25, 20, 33E, 486/25E	4Meg	ZA3800MK	195.00
Z386SX	2Meg	Z-605-1 modules	119.00

MAGNAVOX

286/386SX-16, 386SX-20, 486SX-20 & 386-33 all are 72PIN SIMM
1MEG - \$59.00 4MEG - 195.00 8MEG - 429.00 16MEG - 769.00

MEMORY BOARDS

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16 BIT MEMORY BD. FOR 286, 386 AT • OK-8Meg Bd. 4.0 LIM Compat • New 5 Yr Warr. Convnt. Expend. & Extd. Memory • Supports DOS, OS/2, LIM/EMS & EEMS • Versatile Split Memory Addressing • Operates w/CPU Speeds to 33 MHz • Supports Desqview, Multitask operations • Bd. made by Boca Research, AT plus
OK - \$39.00 2Meg - \$177.00 4Meg - \$265.00 8Meg - \$441.00

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Expanded memory for XT • Lim 4.0 compat. 0-2Meg • Uses 256x1-100
0-K - \$99.00 1Meg \$179.00 2Meg - \$219.00

IBM P/52 32BIT EXPANSION BD.

0-32Meg, Ext-Expend. Memory Bd. for P/52 70, 80, 90, Lm 4.0	0Meg	2Meg	4Meg	8Meg	16Meg	32Meg	64Meg
	\$179.00	\$268.00	\$374.00	\$569.00	\$959.00	\$1935.00	\$3255.00

PS/2 MCA 0-8MEG EXPANSION BD.

0-8Meg Extended and/or Expanded Memory for all IBM
PS/2 Models 50, 50Z, 60, 55SX, 65SX, 16 Bit, 4.0 LIM Compat.
OK - \$119.00 2Meg - 287.00 4Meg - 295.00 8Meg - 471.00

IBM PS/2 SIMM MODULES

IBM PART NO.	WORKS WITH MODEL NO.	PRICE
30F5348 (512K)	30-286	37.00
30F5360 (2Meg)	30-286, 25-286, 50 MTHR BD	124.00
6450375 (1Meg)	80-041	79.00
6450379 (2Meg)	80-111, 311-121, 321, 081, 161	89.00
6451060 (4Meg)	80-A21, A-81, 80-A31, 80-111, 80-311	189.00
6450604 (2Meg)	70-061 E61, 121, 80Z, 85SX, 85SX P-70	89.00
	55LS, 65LS, X-Station 120 & 130, 35SX, 35LS, 40SX	
	70-A21, A-81, 8-21, 8-81 35SX, 35LS, 40SX, Vm P/ 325T	90.00
6450606 (2Meg)	25	35.00
78X8955 (128K)	35SX, 40SX, 55SX, 85SX, 65LS, 85LS	199.00
34F2933 (4Meg)	55SX, 55LS, 85SX, 40SX, 35SX, 35LS	199.00
87F9977 (4Meg)	P/51-286	49.00
1057035 (512K)	P/51 & P/51/386SX 2121	109.00
92F9935 (2Meg)	P/51 & P/51/386SX Model-2121	209.00
92F9694 (4Meg)	56, 57 57SX, 90, 95 P-75 57SLC	95.00
6450902 (2Meg)	Value Point 77 486DX2, 486SX, SVR 85	
	57SX 90, 95 P-75 57SLC, 56, 56SLC P/51 386SX	209.00
	Mod 2123, 2133, 2155, Val P/ 77 486CSD, 486SX, SVR85	
6450128 (4Meg)	Value Point 77 486DX2, 486SX, SVR 85	419.00
	35SX, 40SX	439.00
6450129 (8Meg)	56, 57 57SX, 90, 95 P-75 57SLC	114.00
6450130 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	209.00
	35SX, 40SX, PS Note	399.00
79F0999 (2Meg)	Value Point 77 486DX2, 486SX, SVR 85	109.00
79F1000 (4Meg)	Value Point 77 486DX2, 486SX, SVR 85	209.00
79F1001 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	399.00
07G1826 (2Meg)	Value Point 77 486DX2, 486SX, SVR 85	109.00
07G1827 (4Meg)	Value Point 77 486DX2, 486SX, SVR 85	219.00
07G1828 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	449.00
07G1414 (2Meg)	Value Point 77 486DX2, 486SX, SVR 85	129.00
07G1415 (4Meg)	Value Point 77 486DX2, 486SX, SVR 85	239.00
07G1416 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	449.00
66G0094 (16Meg)	Value Point 77 486DX2, 486SX, SVR 85	1029.00
07G1420 (4Meg)	Value Point 77 486DX2, 486SX, SVR 85	249.00
07G1421 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	449.00
66G0378 (8Meg)	Value Point 77 486DX2, 486SX, SVR 85	285.00
66G0379 (16Meg)	Value Point 77 486DX2, 486SX, SVR 85	769.00
92F8804 (2Meg)	Value Point 77 486DX2, 486SX, SVR 85	119.00

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MODEL	AMT. UPGRADED	CMPO PART #	PRICE
DeskPro 386/33, 386/33L	2Meg Module	115144-001	109.00
486/25, 486/33L	8Meg Module	115561-001	459.00
486/50L, System Pro	32Meg Module	115568-001	1499.00
DeskPro 386/33L, 486/33L	(Exp Bd)	115569-001	279.00
DeskPro 386/25, 386/20	1Meg Module	113131-001	79.00
DeskPro 386S-16MHz	4Meg Module	113132-001	219.00
	1Meg Exp Bd	113633-001	149.00
	4Meg Exp Bd	113634-001	329.00
	1Meg Module	113646-001	79.00
	4Meg Module	112534-001	219.00
DeskPro 386/20E	1Meg Exp Bd	113644-001	149.00
DeskPro 386/25E	4Meg Exp Bd	113645-001	329.00
	1Meg Module	113131-001	79.00
	4Meg Module	113132-001	229.00
DeskPro 286N, 386N	1Meg Module	115568-001	59.00
386SX/20, 386/25M, 486/33M	2Meg Module	115569-001	89.00
486S/25M, 486S/16M	4Meg Module	115569-001	185.00
Port 486G	8Meg Module	128877-001	429.00
M Series Exp Bd	0-64Meg	129180-001	279.00
DeskPro 386/16	1Meg Kit	108071-001	99.00
	4Meg Kit	108072-001	299.00
	1-2Meg Exp Bd	108069-001	239.00
	4-8Meg Exp Bd	108070-001	437.00
DeskPro 286	512K Kit	113012-001	49.00
DeskPro 5/60, 5/66M	8Meg Kit	149911-001	389.00
DeskPro 5/60, 5/66M	16Meg Kit	149949-001	836.00
DeskPro 5/60, 5/66M	32Meg Kit	149912-001	1799.00
DeskPro 5/60, 5/66M	64Meg Kit	149913-001	2999.00
DeskPro 5/60, 5/66M	128Meg Kit	149914-001	7450.00
Pinnacle 386/33, 3/25, 3/25Z	2Meg	141738-001	109.00
	8Meg	141742-001	320.00
Pinnacle 486/4/25S, 4/33, 4/50, 4/66, CDS	2Meg	141883-001	95.00
	4Meg	141884-001	209.00
	8Meg	141885-001	444.00
	16Meg	141886-001	889.00
Prosignia PC Server, 486/33, 486 DSX/66	16Meg	149320-001	786.00
	32Meg	149147-001	1749.00
Prosignia 5/60	16Meg	139132-003	CALL
Prosignia 5/60	32Meg	139132-004	CALL
Prosignia 5/60	64Meg	139130-001	CALL
Prosignia 5/60	128Meg	139132-007	CALL

COMPAQ LAPTOPS & NOTEBOOKS

MODEL	PRICE	MODEL	PRICE
LTE/286	117081-002	99.00	
LTE/286	117081-003	204.00	
LTE/386/20	121125-002	239.00	
LTE LITE/20, 25, 25C	129769-002	239.00	
LTE LITE/20, 25, 25C	129769-003	389.00	
LTE LITE/20, 25, 25C	129769-004	799.00	
LTE LITE 4/25C, 4/23C, 4/33C	142337-002	219.00	
LTE LITE 4/25C, 4/23C, 4/33C	142337-003	449.00	
LTE LITE 4/25C, 4/23C, 4/33C	142337-004	779.00	
SLT/286	110235-001	75.00	
SLT/286	110237-001	315.00	
SLT/386	118303-001	79.00	
SLT/386	118304-001	109.00	
SLT/386	118305-001	229.00	
Contura 320, 325	2Meg	139497-001	103.00
	4Meg	139498-001	199.00
	8Meg	139499-001	369.00
	16Meg	146520-001	209.00
Contura 4/25, 4/25C, 4/25CX	8Meg	146521-001	399.00
	16Meg	146531-001	799.00

PCMCIA VERSION 2.0 (for Pentium & Subnotebooks)

MODEL	PRICE	MODEL	PRICE
S-RAM Cards 1MEG	159.00	14 400/14,400 Data/Fax	319.00
S-RAM Cards 2MEG	189.00	Modems	259.00
Card Pro (made by Data I/O)		9600/9600 Data/Fax Modems	179.00
Transfers data from PCMCIA		2400/9600 Data/Fax Modems	219.00
card to desktop PC, connects		Lan Ethernet (10 Base T)	279.00
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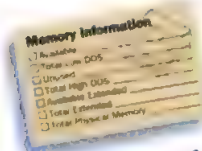
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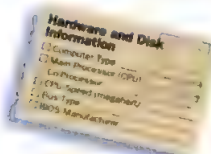
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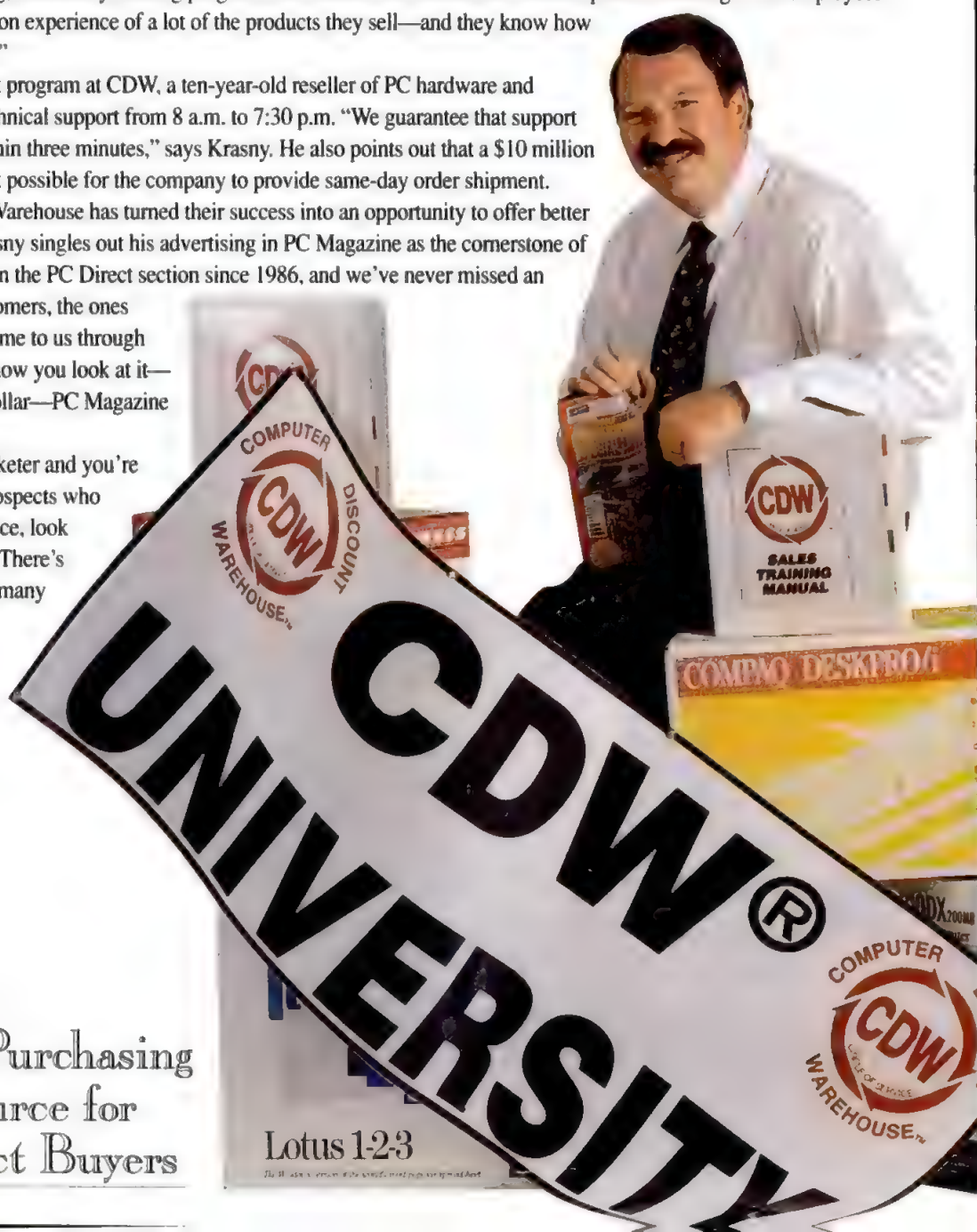
The customer support program at CDW, a ten-year-old reseller of PC hardware and software, includes free technical support from 8 a.m. to 7:30 p.m. "We guarantee that support calls will be answered within three minutes," says Krasny. He also points out that a \$10 million product inventory makes it possible for the company to provide same-day order shipment.

Computer Discount Warehouse has turned their success into an opportunity to offer better customer service, and Krasny singles out his advertising in PC Magazine as the cornerstone of his success. "We've been in the PC Direct section since 1986, and we've never missed an issue. Our most loyal customers, the ones who appreciate service, come to us through PC Magazine. No matter how you look at it—closing rate, calls per ad dollar—PC Magazine is tops."

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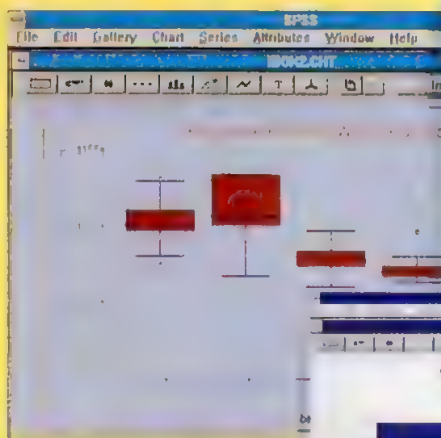
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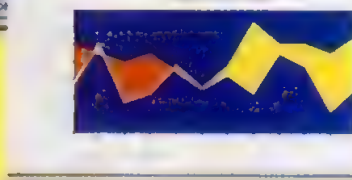
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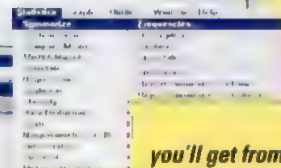
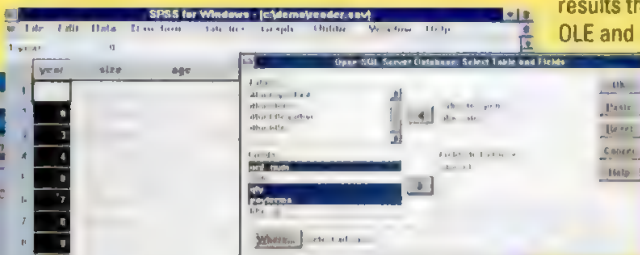
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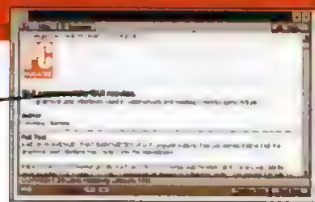
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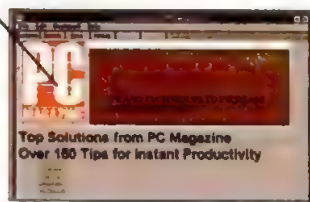
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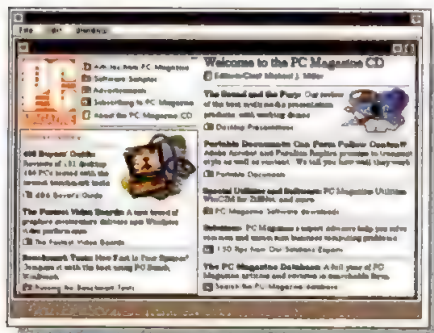
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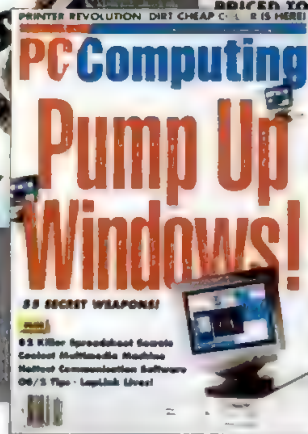


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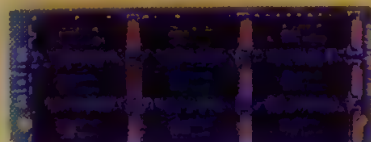
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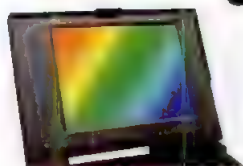
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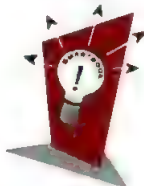


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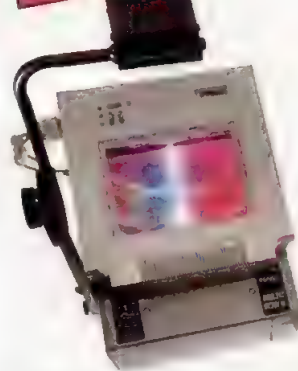
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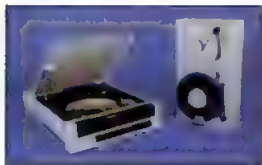
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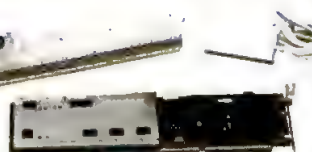
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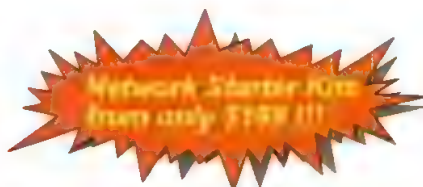


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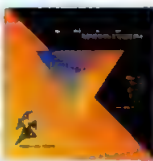
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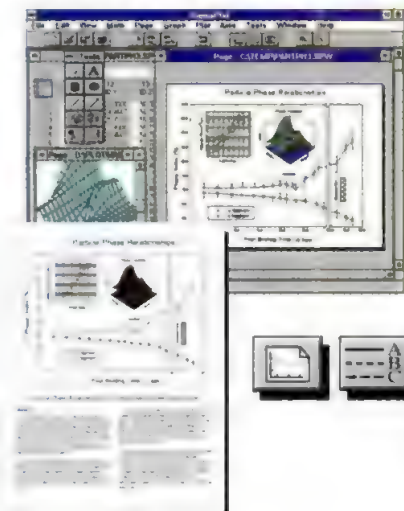
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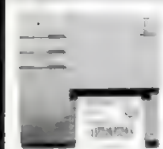
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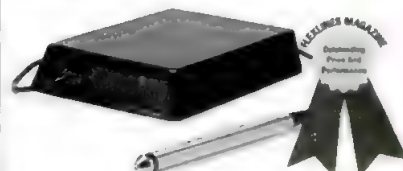
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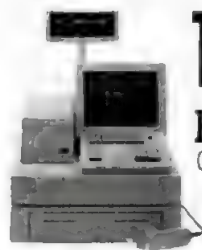
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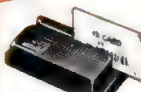
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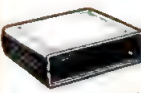
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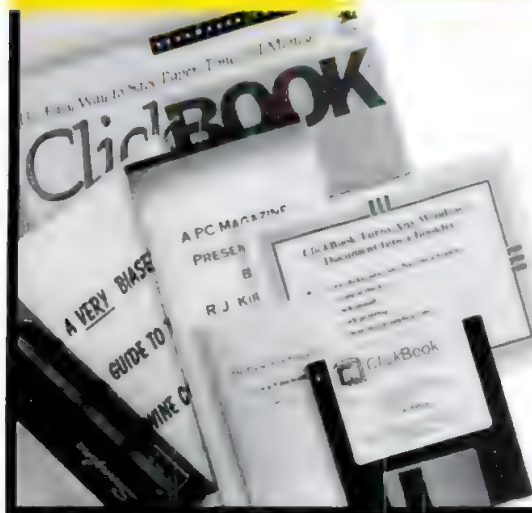
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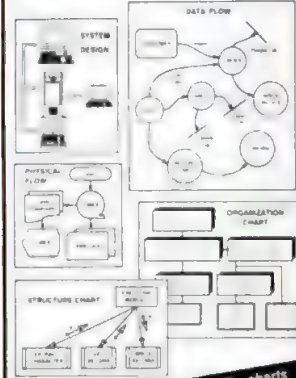
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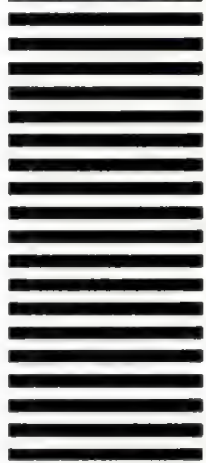
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1. Do you work in a DP/MIS dept.?

01 ☐ Yes 02 ☐ No

2. Please indicate your company or organization's primary business activity. (Check one)

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- 02 ☐ Manufacturer-Aerospace
- 03 ☐ Manufacturer-Other
- 04 ☐ Systems House
- 05 ☐ Computer Consultant
- 06 ☐ Computer Retailer/VAR/VAD Distributor
- 07 ☐ Communications
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- 09 ☐ Education
- 10 ☐ Government
- 11 ☐ Research and Development
- 12 ☐ Data Processing/Computer Service
- 13 ☐ Health/Medical/Legal Service
- 14 ☐ Engineering/Architecture

3. Please indicate your primary business function. (Check one)

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- 02 ☐ Systems Programming
- 03 ☐ Communications
- 04 ☐ Engineering
- 05 ☐ Res./Dev./Scientific
- 06 ☐ Accounting/Finance
- 07 ☐ Computer Consulting
- 08 ☐ Purchasing
- 09 ☐ Operations
- 10 ☐ Production
- 11 ☐ Education/Training
- 12 ☐ Marketing/Sales
- 13 ☐ Medical/Legal
- 14 ☐ Admin./Mgmt.

4. For how many IBM PCs and compatibles do you specify brands of products?

- 01 ☐ 10 or less
- 02 ☐ 11-25
- 03 ☐ 26-99
- 04 ☐ 100 or more

5. Are there any PCs in your office?

- 01 ☐ Linked to mainframe
- 02 ☐ Linked to mini
- 03 ☐ Networked together

6. Please check the equipment currently installed at your location. (Check all that apply)

- 01 ☐ IBM or Compatible PCs
- 02 ☐ IBM or Compatible Mainframes
- 03 ☐ IBM or Compatible Minis
- 04 ☐ Macintosh
- 05 ☐ CD-ROM
- 06 ☐ Windows

7. Do you plan to buy any PC products?

- 01 ☐ Now
- 02 ☐ In 4 to 6 months
- 03 ☐ In 7 to 12 months
- 04 ☐ No definite plans

8. Number of employees in your entire company.

- 01 ☐ 25 or less
- 02 ☐ 26-99
- 03 ☐ 100-499
- 04 ☐ 500-999
- 05 ☐ 1000 or more

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1. Do you work in a DP/MIS dept.?
01. ☐ Yes 02. ☐ No

2. Please indicate your company or organization's primary business activity. (Check one)

01. ☐ Manufacturer Computer Equip., Computers, Software
02. ☐ Manufacturer-Aerospace
03. ☐ Manufacturer-Other
04. ☐ Systems House
05. ☐ Computer Consultant
06. ☐ Computer Retailer/VAR/VAD Distributor
07. ☐ Communications
08. ☐ Finance/Banking/Insurance/Real Estate/Accounting
09. ☐ Education
10. ☐ Government
11. ☐ Research and Development
12. ☐ Data Processing/Computer Service
13. ☐ Health/Medical/Legal Service
14. ☐ Engineering/Architecture

16. ☐ Agr./Const./Mining/Oil/Transp./Utilities
17. ☐ Non-Computer Retailer/Dist.
18. ☐ Other Business or Service

3. Please indicate your primary business function. (Check one)

01. ☐ DP/MIS
02. ☐ Systems, Programming
03. ☐ Communications
04. ☐ Engineering
05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
07. ☐ Computer Consulting
08. ☐ Purchasing
09. ☐ Operations
10. ☐ Production
11. ☐ Education/Training
12. ☐ Marketing/Sales
13. ☐ Medical/Legal
14. ☐ Admin./Mgmt.

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office?

01. ☐ Linked to mainframe
02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location. (Check all that apply)

01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh
05. ☐ CD-ROM
06. ☐ Windows

8. Do you plan to buy any PC products?

01. ☐ Now 03. ☐ In 7 to 12 months
02. ☐ In 4 to 6 months 04. ☐ No definite plans

9. Number of employees in your entire company:

01. ☐ 25 or less 03. ☐ 100-499 05. ☐ 1000 or more
02. ☐ 26-99 04. ☐ 500-999

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Coming Up

Cover Story: Pentium

How fast is fast? What can the power user look forward to in 1994? *PC Magazine* puts 11 of the fastest desktop PCs to the test to see which manufacturers have done the best job of unleashing the power of Intel's Pentium chip. Cool machines? Not really. We also show you how to beat the heat and keep your Pentium from overheating.

Illustration Software

Illustration packages were once geared toward professional illustrators who had the time to learn the nuances of their many tools. Now these programs make it possible for high-level business users and amateur artists to create quality artwork for newsletters, slide-based presentations, and more. *PC Magazine* reviews four packages that make it easy to create artistic, precision, and business illustrations.

Small-Business Accounting/Personal Finance Software

The latest crop of personal finance software programs goes beyond the basics of checkbook balancing and bank account tracking to planning budgets, paying bills, and downloading stock quotes. Windows-based low-end accounting packages bring to small businesses all the ease of a Windows interface, plus an enticing load of innovation. *PC Magazine* looks at five personal finance and nine accounting packages that promise to beef up your bottom line.

Stackable Hubs

Stackable, manageable hubs are an attractive solution to managers of Ethernet networks, particularly those who use 10BaseT cabling. These hubs are far more flexible and expandable than dumb standalone hubs but cost far less than high-end modular enterprise hubs. Their added management capabilities give LAN managers another tool for delivering a fast, accessible network. We review stackable hub solutions from 11 vendors and tell you where the deck is stacked in your favor.

Free Utility

Our next issue's utility, INFORMER, lets you spy on DOS programs to see how they work by intercepting the interrupts used to request services from DOS, the BIOS, and other support programs such as EMM386.SYS. INFORMER monitors the program you specify and gives you insight into how it works.

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After Hours

The New Kid On The Block, Twain's World, It's Legal, Home Lawyer,
Legal Partner, WillMaker, Day of the Tentacle

THE NEW KID ON THE BLOCK

Electronic Verse That's Better, Not Worse

BY JULIE COHEN

There's a new kid on Broderbund's block, and his name is Jack Prelutsky. Prelutsky's 1984 book of children's verse, *The New Kid On The Block*, has become the fourth and most word-oriented installment in the Living Books multimedia CD-ROM series.

The New Kid On The Block, recommended for 6- to 12-year-olds, retains the electronic-book concept: Every time you click on an object, something happens. More than

the previous Living Books, however, this one stresses the words rather than the pictures. Without the colorful drawings and almost frenetic action that's become Broderbund's hallmark, children actually have to read in order to reap the rewards hidden in the simply drawn pages.

Not that The New Kid is dry; in fact, the verse, which grown-ups might regard as sheer doggerel, is quite funny: "We're forty performing bananas, / we mambo, we samba, we waltz, / we dangle and swing from the ceiling, / then turn

very slick somersaults."

Every page holds 10 to 15 hot spots. Clicking on *waltz*, for instance, prompts the ba-

on the table, and the Diatonic Dittymunch, who favors cantatas for lunch. These characters are messy, rambunctious, and usually in some kind of trouble. Just like kids. And these kids are sure to make your kids want to read.

The Diatonic Dittymunch



The Diatonic Dittymunch plucked music from the air, it swallowed scores of symphonies, and still had space to spare.

A HUNGRY DITTYMUNCH snacks on sonatas and cantatas when you click on the keywords.

The New Kid On The Block, \$39.95.

Requires: 4MB RAM, Microsoft Windows 3.0 or later, MSCDEX

1.0 or later, CD-ROM drive. Broderbund Software Inc., 500 Redwood Blvd., Novato, CA 94948; 800-521-6263, 415-382-4600; fax, 415-382-4419. Circle 451 on reader service card

nanas to pair up and dance; forty prompts them to reassemble themselves in the shape of the number 40.

Prelutsky's heroes include Mabel, who eats with her toes

TWAIN'S WORLD

300 Clemens Titles on CD-ROM

BY JOHN R. QUAIN

Bringing literature to the computer screen is a challenge. So Bureau Development should receive extra praise for making Twain's World—a multimedia CD-ROM of the complete works of Mark Twain—so illuminating.

The \$39.95 disk contains more than 300 full-text works by Samuel Clemens, including his novels, short stories, essays, speeches, and personal letters. Each work is supplemented with a publishing history and plot synopsis. If you come across a highlighted word you

don't recognize, such as *Sepoy*, a click of the mouse summons a short definition.

In addition to Twain's inimitable prose, Twain's World contains video and animation

clips, slide shows with narration, and photos. The simple animations are not as captivating as those of some sophisticated children's titles, but the quizzes and short animated segments, such as Tom Sawyer whitewashing a fence, should encourage younger users to read more of Twain's work.

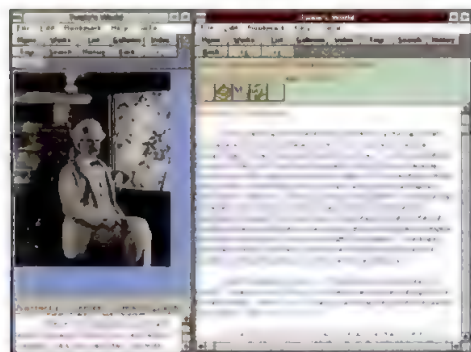
Twain's peripatetic life. Biographical essays, articles, and a graphical time line offer further encouragement to students.

Navigating through Twain's World is easy, with standard word searches, a list of articles, a multimedia gallery, and a conventional table of contents among the tools at your disposal. Parents should find this title an excellent antidote to computer video games.

Twain's World, \$39.95.

Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1, MPC-compatible CD-ROM drive. Bureau Development Inc., 141 New Rd., Parsippany, NJ 07054; 800-828-4766, 201-808-2700; fax, 201-808-2676.

Circle 452 on reader service card



LITERARY GIANT: Twain's World adds insight to Clemens's work with essays, photos, and film.

Among the standouts in this compendium is a 1909 short film, believed to have been shot by Thomas Edison, of Twain enjoying a cigar and afternoon tea. Also of particular interest are narrated slide shows chronicling

Real Ordinary



ReelMagic



There's more to games than a mouth that sort of moves or tinny sound. Now there's a new way to play PC games that's just like sitting in a theater controlling the action with your joystick.

It's ReelMagic™, the new MPEG playback adapter. Available only from Sigma Designs. This incredible add-in board brings the next generation of CD-ROM

ReelMagic™

games to your PC bigger than life.

Say adios to wimpy graphics. Herky-jerky movement. Bogus sound.

And phony scenarios. ReelMagic pumps up the reality meter so you can crank up the fantasy.

We've also included Activision's *Return to Zork* so you can experience the excitement of full motion video now.

It's not real unless it's ReelMagic. Call 1-800-845-8086 ext. 320 for a dealer demo near you. Or you can stick with real ordinary. Oh joy!

Only ReelMagic Makes It Real.™

SIGMA DESIGNS®

CIRCLE 399 ON READER SERVICE CARD

Discover the new generation of ReelMagic games from these manufacturers, and look for more exciting titles coming soon.



© 1993 Sigma Designs, Inc. The Sigma Designs logo is a registered trademark and ReelMagic is a trademark of Sigma Designs, Inc. All other brand names and products are trademarks or registered trademarks of their respective holders.

256 VS. 32,768 COLORS Why settle for a mere 256 colors, offered by current PC games, when ReelMagic gives you theater-quality graphics with over 32,000?

GRUNTS VS. CD-QUALITY AUDIO Get 16-bit CD-quality sound that plays Sound Blaster™ and Windows™ compatible software. The 8-bit audio you're used to just doesn't compare.

5 FPS VS. 30 FPS ReelMagic-compatible games run at 30 frames-per-second, TRUE full-motion, so you avoid jerky, blocky images.

1/4 VS. FULL SCREEN Now you can get theater-quality video in a full-screen image for a realistic, movie-like experience.



THE VIRTUAL ATTORNEY

Four Legal Packages for Laymen

BY BERNIE YEE

Law seems to take up more and more of our business and personal lives as well as our pocketbooks. Yet many of the simpler tasks a lawyer may perform on your behalf—drafting simple wills, promissory notes, and other simple contracts—are often a matter of filling in the blanks on a prepared form. Legal software does this job admirably by prompting you with questions and translating your responses into a written contract. We've looked at four programs. It's Legal is the least expensive and easiest to use. Home Lawyer is flexible but somewhat outdated. Legal Partner should work best for attorneys, while WillMaker is a fine program for anyone drafting a simple will. Not only does

the software supply you with a legal document, you learn what the document means and does.

Since larger businesses usually have law firms full of attorneys on retainer, the legal software market is aimed at small businesses and individuals. General-practice attorneys, too, can save time with these products by using or modifying the forms provided here. Legal Partner, for example, contains a new-document template, and Nolo Press supplements WillMaker with a wide variety of standard forms that are easily adaptable.

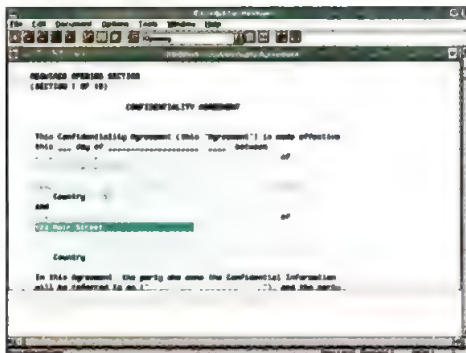
As you might expect, these programs lack flexibility, not to mention the ability to draft documents creatively. Nonetheless, they may provide solid, conservative forms for use in your business and personal affairs. This function alone should save you some legal fees.

PARSONS TECHNOLOGY INC.

It's Legal

Parsons Technology may be the king of low-cost, home-use software. It's Legal, Version 4.0, often available for as little as \$29.95, is designed for personal and small-business use, and it shows. This application is the easiest to use among the products reviewed here, with many interactive and dynamic prompts, and help suggestions given along the way.

It's Legal has evolved over



EASY INTERACTION: It's Legal has a wide array of easy-to-use forms.

the past few years, culminating in an easy-to-use Windows version of the DOS-based software. This program provides basic documents an attorney would draft for home users and small-business owners.

Estate instruments include a simple will, living trust, living will, and health-care power of

attorney (all customized by state). Business forms include corporate minutes, notice documents, employment documents and consulting agreements, promissory notes, and equipment leases. For consumers, the program includes many expertly drafted letters, such as credit-rating challenges, debt demand letters, and complaints to companies, the Better Business Bureau, or the attorney general. Additional accessories include a notepad, a calculator, and an amortizer.

It's Legal lacks an on-line interview process, but on-line help provides a brief overview of each document's function. Although this overview does not require legal knowledge, you will need some business sophistication to know how to use a promissory note or get involved in an equipment lease. You would be well advised to consult a live attorney for handling such complex areas, even though the program provides the tools.

It's Legal provides more documents for the buck than any other package available. Couple that with a smooth interface and low price and this package becomes a no-lose proposition for PC users willing to take legal matters into their own hands.

It's Legal, Version 4.0, \$69.00.

Requires: 640K RAM, 2MB to 10MB hard disk space, DOS 2.11 or later. For Windows version: Microsoft Windows 3.1 or later. Parsons Technology Inc., One Parsons Dr., P.O. Box 0100, Hiawatha, IA 52233; 800-223-

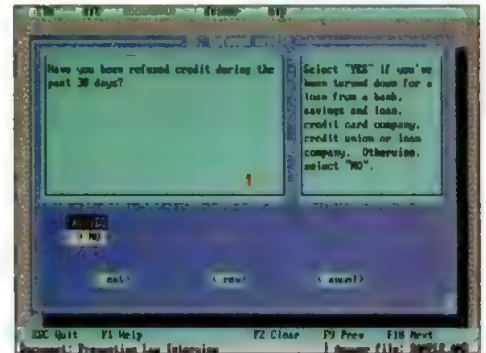
6925, 319-395-9626; fax, 319-395-7449.

Circle 453 on reader service card

MECA SOFTWARE INC.

Home Lawyer

A good, solid product, Home Lawyer has lost some ground to newer packages like It's Legal but remains flexible and



Q & A: Home Lawyer's interview process determines your needs.

competent enough in its areas to be worthy of consideration.

For the past few years, Home Lawyer has been a solid performer for personal legal services on a PC, with 16 common legal documents, including wills, powers of attorney, employment forms, credit and collection documents, leases, and bills of sale. The package even throws in a consumer complaint letter for good measure.

The most important part about drafting a legal document is getting the right information from the client. Home Lawyer's effective interface makes this crucial part easy. The program provides a Preventive Law Interview for first-time users to determine their legal needs. Simply answer a series of questions and Home Lawyer refers you to its general on-line information guide, entitled Personal Law Topics. Similarly, those seeking to make a will can fill out the Estate Planning Work-

Imagination. Innovation. Insight.

The How It Works Series from Ziff-Davis Press

"... a magnificently seamless integration of text and graphics ..."

Larry Blasko, The Associated Press, reviewing *PC/Computing How Computers Work*

No other books bring computer technology to life like the *How It Works* series from Ziff-Davis Press. Lavish, full-color illustrations and lucid text from some of the world's top computer commentators

make how it works books an exciting way to explore the inner workings of PC technology

PC/Computing How Computers Work

A worldwide blockbuster that hit the general trade bestseller lists! *PC/Computing* magazine executive editor Ron White dismantles the PC and reveals what really makes it tick.

How to Use Your Computer

Conquer computerphobia and see how this intricate machine truly makes life easier. Dozens of full-color graphics showcase the components of the PC and explain how to interact with them.

All About Computers

This one-of-a-kind visual guide for kids features numerous full-color illustrations and photos on every

page, combined with dozens of interactive projects that reinforce computer basics, making this an exciting way to learn all about the world of computers.

How To Use Word

Make Word 6.0 for Windows Work for You!

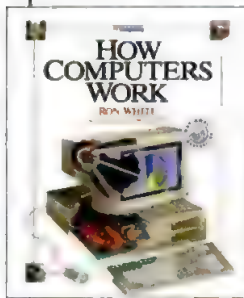
A uniquely visual approach puts the basics of Microsoft's latest Windows-based word processor right before your eyes. Colorful examples invite you to begin producing a variety of documents, quickly and easily. Truly innovative!

How To Use Excel

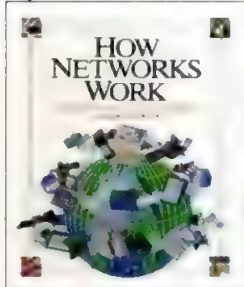
Make Excel 5.0 for Windows Work for You!

Covering the latest version of Excel, this visually impressive resource guides

beginners to spreadsheet fluency through a full-color graphical approach that makes powerful techniques seem plain as day. Hands-on "Try It" sections give you a chance to sharpen newfound skills.



ISBN: 094-7 Price: \$22.95



ISBN: 129-3 Price: \$24.95

How Networks Work

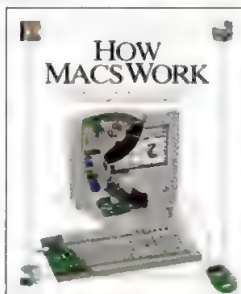
Two of the most respected names in connectivity showcase the PC network, illustrating and explaining how each component does its magic and how they all fit together.

How Macs Work

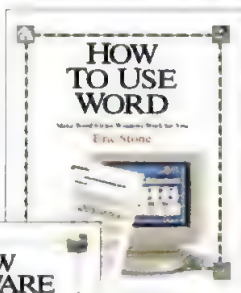
A fun and fascinating voyage to the heart of the Macintosh! Two noted *MacUser* contributors cover the spectrum of Macintosh operations from startup to shutdown.

How Software Works

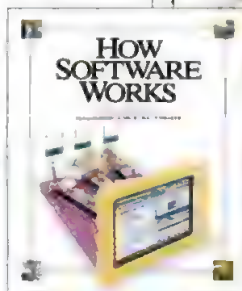
This dazzlingly illustrated volume from Ron White peeks inside the PC to show in full-color how software breathes life into the PC. Covers Windows™ and all major software categories.



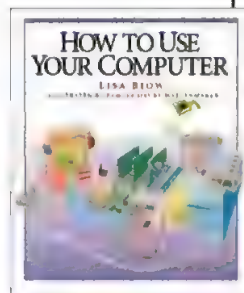
ISBN: 146-3 Price: \$24.95



ISBN: 164-6 Price: \$17.95



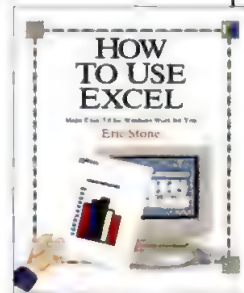
ISBN: 133-1 Price: \$24.95



ISBN: 155-2 Price: \$22.95



ISBN: 166-8 Price: \$15.95



ISBN: 185-4 Price: \$17.95

Available at all fine bookstores or call 1-800-688-0448, ext. 81672.

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Home Lawyer

sheet, which makes a client consider the factors of property division before making out a will. The Personal Law Topics section explains basic areas of law relevant to Home Lawyer's forms and, most important, advises you on when to consult a lawyer.

Each legal document is assembled after the user answers the questions in the interview. This process makes you consider your decisions in distributing your property under a will. You can then print out a completed document, or save the document as a text file and continue modifying it with your word processor.

Home Lawyer, \$89.95.

Requires: 512K RAM, 3MB hard disk space, DOS 2.0 or later. MECA Software Inc., 55 Walls Dr., P.O. Box 912, Fairfield, CT 06430-0912; 203-256-5000; fax, 203-255-6300.

Circle 454 on reader service card

COMMONTOUCH INC.

Legal Partner

Legal Partner feels as if it was written by lawyers. Its bare-bones interface and proud use of "legalese" assume a degree of knowledge the other packages don't.

Legal Partner features more than 150 forms, ranging

from copyright licenses to limited powers of attorney, but doesn't cover such topics as wills and durable powers of attorney. The authors claim that these documents are too complex and important for a fill-in-the-form approach, a typically conservative legal attitude.

Legal Partner has a simple, context-sensitive help system but lacks a fancy interface. Nor will the documentation be of much help: The complexity of many of the documents will definitely prove to be intimidating to the layman. But the documents available are impressively complete for sophisticated businesspeople, and they even allow users to input commonly used documents for later fill-in usage.

The documentation adequately explains how to use the software, but it is sadly silent as to any basic legal discussion of the effect of each document. Documents such as trade-secret confidentiality agreements and indemnification agreements presuppose a good sense of their legal usage already; in other words, if you don't know what they're for and when they should be used, you should talk to a lawyer first.

Legal Partner may very well find its way onto your attorney's hard disk, since the documents are fairly sophisticated and the program allows

users to enter their own commonly used documents into the program for automated filling out. Though the text entry feature is not particularly sophisticated, it's fine for entering shorter con-

tracts, such as releases, verification pages for court documents, and other commonly used documents. This package is best saved for attorneys themselves.

Legal Partner, \$95.00. Requires: 320K RAM, 500K hard disk space, DOS 2.1 or later. CommonTouch Inc., P.O. Box 21, Newton, MA 02159; 800-762-6789, 617-964-7740; fax, 617-863-5518.

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NOLO PRESS

WillMaker

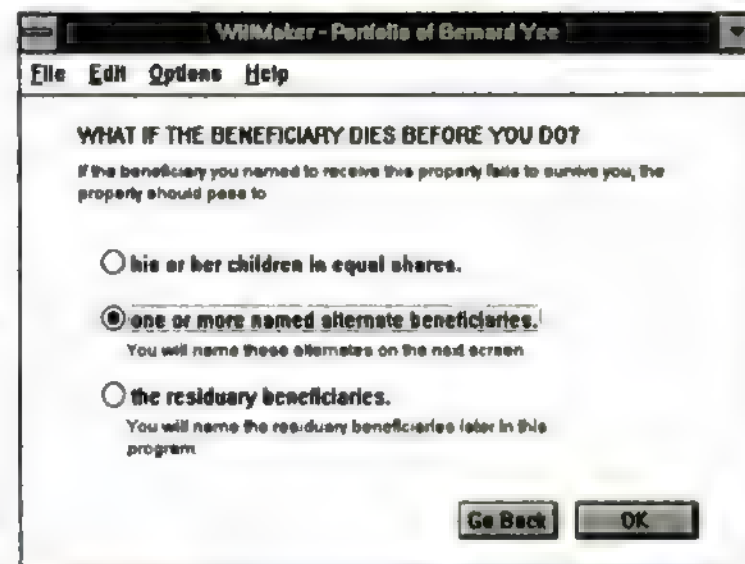
The general packages in this review are somewhat like Swiss Army knives: good all-purpose tools. But if you just want to draft a will, WillMaker, from Nolo Press, is a better option. In fact, many general-practice attorneys may be interested in Nolo's product.

WillMaker is an outstanding program, available in both DOS and Windows versions, and the documents it generates are top-notch. The program breaks down the entire will-drafting process into its component parts, so that any user with the desire to learn about the estate process will come away with an excellent basic knowledge.

To keep this process simple, WillMaker interviews the user before it assembles the will. Questions pop up, one at a time, on the screen, and each screen has hypertext and corresponding on-line help, with topics covered in even more depth in the manual. No fancy graphics here: The interface is text-based but per-

fectly adequate for the task at hand.

WillMaker comes with outstanding documentation. The manual explains in simple terms the legal effect of terms such as *joint tenancy*, *residuary estates*, and more. It explains the program's limits. For example, you won't be able to draft codicils, amendments to a will, which are



FOR WILLS ONLY: WillMaker produces top-notch documents.

often challenged in court. If you insist on using them, you're left to consult a human attorney. Most practical, the documentation contains plenty of examples, using fictitious people with particular sets of estate goals and circumstances.

While it's no substitute for a real attorney and it's more expensive than its jack-of-all-trades rivals, WillMaker offers more flexibility in creating a specialized document than any other package reviewed, and it provides the best drafts to use.

WillMaker, \$79.95. Requires: 512K RAM, 1.2MB hard disk space, DOS 3.0 or later. For Windows version: 4MB RAM, 1.5MB hard disk space, Microsoft Windows 3.1. Nolo Press, 950 Parker St., Berkeley, CA 94710; 800-992-6656, 510-549-1976; fax, 800-645-0895.

Circle 456 on reader service card



BEST FOR LAWYERS: Legal Partner provides more than 150 forms.

DAY OF THE TENTACLE

A Goofy Return to Maniac Mansion

BY BARRY BRENESAL

Long-time gamers probably took a crack at Maniac Mansion, one of the first graphics adventures, several years ago. The sequel to this classic is Day of the Tentacle, a loose takeoff of the classic sci-fi horror film *Day of the Triffids*. *Triffids* featured a blind human race and carnivorous plants; Tentacle is somewhat more upbeat. The human race isn't blind, just ineffectual. And not all the plants are bad. Just one.

The plant in question is Purple Tentacle, which drank some toxic waste and, in the hallowed tradition of ecological disaster films, mutated into a warped

supergenius bent on world domination. Three college kids alone—Bernard (a computer whiz), Laverne (a rather twitchy med student), and Hoagie (a heavy-metal roadie)—can save humanity.

The twist: All three kids fall afoul of a time-traveling device built with cut-rate equipment. While Bernard remains in the present, Laverne is catapulted 200 years into a very disagreeable Tentacle-ruled future. Hoagie ends up at the same location 200 years earlier.

The kids can exchange most objects they encounter across time. That's the only way you'll solve the puzzles that help foil the Purple Tentacle.

Visually, this game resem-

bles the offbeat cartoons of the fifties and sixties: Gerald McBoing Boing and Mr. Magoo come to mind. Buildings and trees lean at odd angles. Interiors suggest they were designed by architects with deconstructionist tendencies. And the voice of Richard Sanders (Les Nessman of "WKRP in Cincinnati") suits the nebbishy Bernard to a T.

Tentacle's broad physical humor is offset by some deadpan satire. The Tentacle Judging Committee of the human beauty contest is particularly good in this respect.

But don't come to Day of the Tentacle expecting subtlety. It's goofy fun—no worse



A TENTACLE'S WORLD: Three unlikely heroes battle to save humankind.

than television, and with no commercial interruptions. □

Day of the Tentacle, \$69.95. Requires: 4MB RAM, DOS 3.1 or later, MSCDEX 2.1 or later, CD-ROM drive. LucasArts Entertainment Co., P.O. Box 10307, San Rafael, CA 94912; 800-782-7927, 415-721-3300; fax, 415-456-4381.

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MOVING?

Please write to: PC Magazine, P.O. Box 54093, Boulder, CO 80322. Include your mailing label from a recent issue of PC Magazine for faster service. Please allow up to 60 days for change of address to take place.

[*Hillary not included.]

SimHealth gives you everything you need to re-make the American health care system—except the First Lady.

A unique new simulation software created by Maxis and brought to you by the Markle Foundation, SimHealth elects you leader. Now you can build a health policy in tune with your values, and watch it in action on a virtual "Main Street." Will you be re-elected? You'll certainly be more engaged, entertained and educated about our national debate than you ever thought possible. So why not give us a call? Because at \$29.95—that's 25% off retail—SimHealth is just what the doctor ordered.

SIM HEALTH
A Markle Foundation and Maxis Company Simulation

1-800-U-CHANGE

MAXIS

 The Markle Foundation

IBM or 100% compatible with DOS, 386, SVGA.

CIRCLE 111 ON READER SERVICE CARD

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Geez... Give Beverly a Break!

"We'll custom build a system just for you. It's a personal commitment from Alice, Gregg, Jeff, Beverly and their associates at the IBM Personal Computer Company. Thousands of IBM people—many working around the clock—to keep you personally delighted with everything we do for you."—IBM ADVERTISEMENT

Electric Mail

Lotus cc:Mail 2.0 Adds Rules-Based Messaging

BY DON WILLMOTT

Release 2.0 of Lotus Development Corp.'s cc:Mail

cc:Mail only gives you access to five unattractive fixed messages



I'm shocked, SHOCKED, to find this mistake in PC Magazine (and with my name on it, too!).



Look at the Toshiba Portable Navigation System. Then look out the car window. Drive carefully! (Aerospace America.)

Classified Intelligence

"Macintosh/Management trainer: Seeks work. Free introductory cheesecake."

—OTTAWA CITIZEN

OPHTHEMANT

Ah, Posterity!

At the Smithsonian Institution's National Museum of American History, a computer exhibit includes a stack of old *PC Magazine* issues being used as a pedestal for a computer. And what kind of PC sits atop the magazines? An Apple II, of course.



Timing Is Everything

September 12, 1993: Raymond Burr dies. September 13, 1993: *InfoWorld* has Raymond Burr, as Perry Mason, on its front page to illustrate an animation story.



Richard Tennant

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Steve Pogson, Jim Reinertson, and E. A. Torgan.

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[†]1993 J.D. Power and Associates Desktop Personal Computer Satisfaction Study conducted among business users and based on 1,956 user respondents.

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